167766
APR 4 1887

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XLVI.—No. 5. Whole No. 665. | NEW YORK, WEDNESDAY, MARCH 2, 1887. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on the 2d and 16th of each month, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
Western Gas Association..... 129
Ohio Gas Light Association..... 129

EDITORIALS—
The New England Association's Meeting..... 130
An Astounding Proposition..... 130
Busy Constructors..... 130
Seventeenth Annual Meeting of the New England Association of Gas Engineers—Official Report..... 131

First Day, Morning Session—Roll Call—Applications for and Election to Membership—Invited to Witness the Proceedings—The Guild Tenders Hospitalities—Responses and Regrets—President's Address—Committee on President's Address—Treasurer's Report—Committee on Nominations—Report of Board of Directors—Reading the Papers—The Effect of Reduction in Price of Gas, by the Hon. A. M. Norton—Discussion—Some Thoughts on Purification of Gas by Iron Oxide, by C. J. R. Humphreys—Discussion—Afternoon Session—Report of Nominating Committee—Election of Officers—The Treatment of Naphthaline, by E. G. Pratt—Discussion—Candle Power and Illumination, by C. F. Prichard—Units of Photometry, by R. B. Taber—Joint Discussion—Second Day, Morning Session—The Introduction of High Candle Power Burners, by F. S. Richardson.

*An Improvement (but on Paper only) in Apparatus for Making Gas, by Frederic Egner..... 145
*Smale's Pneumatic Hydrometer..... 146
Special English Correspondence..... 146

Temperature and Consumption of Gas—Curious Flames—The Foulis Gas Fire—The Hefner-Alteneck Photometrical Standard—Gas Business During the Second Half of 1886—The London Gas Companies.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 147

They Voted for Electricity—Gas Works for Dodge City, Kas.—President Morton on Measurement of Arc Lights—Capital Stock Increased—Preparin for the Near Future—Huron wants a Gas Works—Sorely Bereaved—The Test was Illegally Made—To Last for Twenty Years—Gas Legislation in California—Killed by the Current—A Big Electric Lighting Company—Another Golden State Company—Settling the Lighting Question at Xenia, Ohio—Annual Meeting at Nantucket, Mass.—Will They Succeed?—And yet Another—An Interim Dividend of Four Per Cent.—Flatbush (L. I.) Street Lighting Contract—The Worcester Hearing—Gas Engines in Fashion at St. Paul, Minn.—The American Electric Manufacturing Company—To Push the Exhauster Branch of Their Business—Annual Election, Augusta, Ga.—Annual Election, Consumers Gas Company, Chicago, Ills.—Bids for Public Lighting, Scranton, Pa.—To Provide Greater Security—The Malden Company's Record—The Frackelton Portable Gas Kiln—It Might have been Worse—Fix up the Pipes—Tyrone, Pa., to be Lighted by Electricity—Brother Alexander's Invention—New Holder for the Springfield Gas Light Company.

CORRESPONDENCE—
Mr. Egner in Further Explanation of that "Chapter"..... 149
The Market for Gas Securities..... 150

[OFFICIAL NOTICE.]

Western Gas Association.

SECRETARY'S OFFICE, QUINCY, ILL., Feb. 25, 1887.

The Tenth Annual Meeting of the Western Gas Association will be held at St. Louis, Mo., on the 11th, 12th, and 13th days of May. The Southern Hotel has been selected by the Committee of Arrangements for our abiding place, and the choice cannot fail to meet with the hearty approval of our members. With regard to a hall for our business sessions, it has been thought best to inaugurate a departure from our old-time custom of accepting (simply because it was "handy") any vacant room in the hotel building which might be placed at our disposal. Those who remember our unfortunate experience in St. Louis, three years ago, will, I am confident, give the new experiment an unqualified indorsement. A hall admirably suited to our requirements, on the corner of Sixth and Walnut streets, just one block from the Southern, has been secured by our diligent Committee, and when the hour for assembling arrives our members will applaud the selection as a most happy one. That the acoustic properties are admirable has been repeatedly demonstrated, while the size, location, and facilities of all kinds are faultless.

Your Secretary will, within a few days, send circular letters to our members generally making his regular yearly request for the preparation of essays for presentation at our Tenth Annual. Let no one feel slighted in case his name be overlooked, but get his paper ready just the same, feeling assured that it will be listened to with that rapt attention which a gas man's contribution always commands.

An effort will be made to secure reduced railway fares for those in attendance, but with what success, or lack of success, I am not now prepared to state. An announcement with respect to this matter, as well as to other topics of interest to the Association, will be made later on in these columns.

A. W. LITTLETON, Secretary.

[OFFICIAL NOTICE.]

Ohio Gas Light Association.

OFFICE OF SECRETARY, COLUMBUS, OHIO, Feb. 23, 1887.

To the Members of the Ohio Gas Light Association:—But a short time elapses before the 16th of March, the date of the Third Annual Meeting of this Association. Preparations for this meeting are under full headway, and the prospects of its success are very flattering. As stated in a former circular, there are two essentials to a good meeting—viz., a sufficient number of papers to be read and discussed, and a good attendance. The first of these requisites has been secured. All that remains is for the members of the Association, and all gas men in the State, to recognize and take advantage of the opportunity afforded by this meeting to help each other, by being present to listen to the reading of the papers, participate in their discussion, and enjoy the benefits of an interchange of ideas in private conversation.

There has probably never been a time in the history of gas lighting when questions of more importance demanded the attention of gas men than the present, and these questions are to be thoroughly discussed at the forthcoming meeting. No gas man can afford not to avail himself of this privilege of hearing discussed, in the light of recent experience and advanced thought, such subjects as "Gas Commissions," "Gas and Electricity," "Coal and

Water Gas," etc. Other subjects relating to the practical operation of gas works will be found in the following list of papers, which are promised for the meeting:

President's Address, Emerson McMillin, Columbus, O.; "Gas and Electricity—Two Interests or One?" Geo. W. Graeff, Jr., Philadelphia, Pa.; "Uniform vs. Special Rates for Gas," C. M. Converse, Delaware, O.; "Relative Cost of Coal and Water Gas," Geo. H. Christian, Jr., Norwalk, O.; "Hydraulic Lifts for Purifier Covers," Jos. Light, Dayton, O.; "Will Iron Purification Increase or Diminish Troubles Caused by Naphthaline?" John Fullager, Cincinnati, O.; "Gas Commissions," M. A. Gemuender Columbus, O.; "Is it a Good Policy for Gas Companies to Sell Gas for Stoves, Engines, etc., at a Reduced Price?" W. W. Prichard, Ironton, O.; "Choked Stand-Pipes; Is there a Remedy?" N. Kinsman, Springfield, O.; "Tar as an Enricher," E. W. Hamlin, Wilmington, O.; "Cause and Prevention of Stoppage in Burner Tips," Eugene Printz, Zanesville, O.; "Economy in the Management of a Gas Works," Moses Coombs, Jr., Youngstown, O.; "Condensation and the Elimination of Tar," T. A. Bates, Circleville, O.; "A Regenerative Furnace Adapted to a Small Works," Irvin Butterworth, Columbus, O.; "Gas *with* Electricity," Thos. Wood, Sandusky, O.

In addition to the foregoing, it is hoped that the President's offer of $25 for the best and $10 for the second best paper on the subject, "How shall we get rid of Naphthaline Crystals about the Works and still maintain High Heats?" will call forth volunteer papers.

The headquarters of the Association, and the place of its meeting, will be the Beckel House, corner of Third and Jefferson streets, Dayton, Ohio, where a rate of $2.50 per day, for members and their families, has been secured.

The meeting will convene at 10 A.M., Wednesday, March 16, 1887, and continue two days. Irvin Butterworth, Secretary.

THE NEW ENGLAND ASSOCIATION'S MEETING.

That this year Dame Nature had been in a gentler mood than was the case a twelvemonth ago was made apparent to the traveler who had occasion to journey eastward at about mid-February of the past two years. The rivers seemed content with the beds allotted them, and so the bridges kept their perpendicular, with the pleasant result that the railway passenger, having discounted the "ordinary risks" of travel, could count on reaching his destination on time. With such an amelioration of the conditions upon which travel is dependent, Young's Hotel, on the evening of February 15th, contained quite a delegation of the gas men, and insured the fact that when President Harbison should on the morrow call the 17th Annual Meeting of the New England Association of Gas Engineers to order, he would be greeted by an imposing array of faces and forms "on duty bent." Perhaps it would be well to mention that early comers had handed them an *open sesame* to a certain suite of rooms in "Youngs," where a jolly set of hosts, in the persons of the Messrs. Davis, Sprague, Langford, and Waldo, stood ready to receive and welcome them. The later comers also received the same attention, and it may be said that the courtesies were heartily appreciated.

The original anticipation of an excellent attendance, representative in every respect, was more than verified when President Harbison announced the formal opening of the sessions, and those who were in attendance at the first annual meeting of the Association, held in the rooms of the Board of Trade Building, Boston, many years ago, when Mr. W. W. Greenough occupied the Presidential office, now had ample reason to be proud over the proof visible that the Parent Association had been true to the precepts of its founders. Secretary Nettleton's preliminary warnings had been heeded, and it seemed to us as if almost every New England gas man found time to be on hand. Many visitors responded to the invitations, and their names will be found in our report of the proceedings on other pages of the Journal. It will be remembered perhaps that we predicted some time since what sort of presiding officer Brother Harbison would prove to be; but we hardly made the case strong enough then, for he wielded the gavel with the art of a master. We had hoped that the President's address would contain some decided personal opinion in regard to the operation of electric lighting plants by gas suppliers; but while not handling the subject in detail, perhaps his summary of the present situation could not have been more concisely or pithily put. In fact his remark concerning that matter, "The proper solution, I apprehend, must be arrived at by each individual gas company, from its own standpoint and existing circumstances and surroundings," places the point in a truthful, exact and proper light. In regard to the technical matters presented through the medium of the papers read, too much in favor of the authors' contributions cannot be said. This only shows how subjects that have been so often handled, or until one would almost claim them to have become thoroughly threadbare, can be made of extreme interest. Certainly, no other list of papers ever presented at the sessions of the New England Association gave rise to more animated and valuable discussions than those debated at the 17th annual gathering. In passing, we cannot forbear to express our gratification at the instructions given by the Association to Messrs. Prichard and Taber to continue their researches in the perplexing field of photometry. These gentlemen are well qualified to thread their way, safely and surely, through the mazy paths of the rather obscure region which duty has mapped out for them; and we look forward to '88 for an interesting *resume* of their surveys. Mr. Humphreys, as usual, was scholarly and precise; Mr. Pratt we welcome to the field of authorship with the understanding that his fellow members are anxious to hear from him again. And, in fact, we must also place in the same category Messrs. Norton and Richardson. Indeed, we cannot blink the fact that Mr. Richardson's treatment of his subject, aside from the well displayed way in which he portrayed the principal portion of his theme, brought directly before the Association an available opportunity—one eagerly seized upon—for ventilating the merits and probable disposal of the problem involved in the joint supply of gas and electricity. This discussion, which was voluminous and searching, evidently shows that the Eastern gas men are practically unanimous on the matter; and that it is but a question of time when the fraternity of that section will have practically embarked on the seas of joint supply. Hardly less interesting was the dialogue which followed the reading of the paper presented by Nashua's Honorable gas man. Mr. Norton's figures set argument at naught, for they were simple records of what had been accomplished by the "reduction process." It goes without saying that President Harbison had "strong" opinions on this subject (he has had them for some time back), and we expect they will remain strongly within him until the dollar mark is reached—not that we mean to say that he is alone in this respect. No; he has plenty of company, and the ranks are being constantly added to. The Association may well congratulate itself on the list of papers for '87.

A particularly graceful act was the election to Honorary Membership of the distinguished gentlemen—Gen. Andrew Hickenlooper, of Cincinnati, Ohio, Mr. Emerson McMillin, of Columbus, Ohio, and Mr. Geo. A. McIlhenny, of Washington, D. C.—proposed for that honor by the Board of Directors. All of them have been tried, and nobly have they answered the tests.

To say that the banquet was a success is explained when it is mentioned that Young's *chef* was intrusted with the details; and we can only further note that President Harbison carried out the *role* of entertainer to the letter and the law. Flanked as he was by ex-Governor Littlefield, of Rhode Island, and Mr. Barker, of the Massachusetts State Gas Commission, the modest Connecticut gas man did not lose an inch of his stature. Viewed in any and every light the 17th annual was a complete success, and the record of its sessions is proof that the admonitions given to the members by ex-President Greenough, in his forceful address, delivered to many of them 17 years ago, have borne good fruit.

AN ASTOUNDING PROPOSITION.

A circular sent out to the stockholders of the Chicago (Ills.) Gas Light and Coke Company, by President E. T. Watkins, who acts on behalf of the Board of Directors, has aroused much speculation in the fraternity. The circular states that a "proposal to purchase the majority or the whole of the capital stock has been submitted to the Board of Directors, by responsible parties, at the rate of $37.50 cash for each $25, a premium of 50 per cent. on the par value." The circular makes no mention of the "responsible parties" by name; but does strongly recommend the owners of shares to accept the proposal. Four reasons are set forth in favor of the acceptance; but it strikes us that the "reasons" present the best possible argument against the proposed transfer. For instance, reason No. 2 starts out with the assertion, "The great increase and development in the demand for gas, created by the low price, have been insufficiently met by the capacity of our works and mains, and a large outlay will be required this year for necessary extensions." And in what more remunerative direction could money be placed than in attempting to satisfy the demand? The Company is certainly earning 8 per cent. or over on its present capital, and the "new business" assuredly ought to maintain that rate of profit on any reasonable capital extension necessary. The proposal has elicited a notice from Brown Brothers, that they are willing to take all stock that may be offered to them on a basis of $42.50 per share of $25. If the stock of the Chicago Company is worth so much to outsiders, why would it not be worth still more to those who now have it in their possession? Perhaps the present managers are tired of the gas business; if so, why ought they not make room for others of the present owners who are more energetically inclined?

Busy Constructors.—Mr. Emil Lenz is under contract to erect seven benches of eights, on the Munich plan, in the works of the Boston (Mass.) Gas Light Company. He will also put in one bench at the works of the Derby Gas Light Company, Birmingham, Conn. This latter plant, it will be remembered, is under the management of the Secretary of the New England Association of Gas Engineers. Mr. James R. Floyd, of this city, is now engaged in putting on 70 of his patent self-sealing retort lids in the Boston Company's plant.

[Official Report.]

Seventeenth Annual Meeting of the New England Association of Gas Engineers.

Held at Young's Hotel, Boston, Mass., Feb. 16 and 17, 1887.

First Day—Morning Session—Feb. 16.

The New England Association of Gas Engineers convened in 17th annual session at Young's Hotel, Boston, Mass., at 10 A.M. on Feb. 16. The President, Mr. John P. Harbison, of Hartford, Conn., occupied the chair; and the Secretary, Mr. C. H. Nettleton, of Birmingham, Conn., recorded.

Roll Call.

The following members answered to their names during the progress of the roll call:

Honorary Member.

Jos. R. Thomas, Editor Am. Gas Light Journal, N. Y. City.

Active Members.

C. T. Frost, Rockland Me.
A. F. Cooper, Exeter, N. H.
L. P. Gerould, Manchester, N. H.
J. M. Hill, Concord, N. H.
A. M. Norton, Nashua, N. H.
H. A. Norton, Nashua, N. H.
John Andrew, Chelsea, Mass.
H. A. Allyn, Cambridge, Mass.
H. A. Atwood, Plymouth, Mass.
D. Brayton, Brockton, Mass.
J. H. Burnham, Boston, Mass.
G. D. Bill, Malden, Mass.
D. Boynton, Chicopee, Mass.
G. D. Cabot, Lawrence, Mass.
O. E. Cushing, Lowell, Mass.
H. F. Coggshall, Fitchburg, Mass.
D. W. Crafts, Northampton, Mass.
P. Coyle, Boston, Mass.
J. A. Coffin, Gloucester, Mass.
A. M. Copp, Boston, Mass.
F. R. Davis, Athol, Mass.
S. Fowler, Westfield, Mass.
M. S. Greenough, Boston, Mass.
J. L. Hallett, Springfield, Mass.
C. J. R. Humphreys, Lawrence, Mass.
E. Jones, Boston, Mass.
M. Jewett, Clinton, Mass.
E. C. Jones, Boston, Mass.
H. B. Leach, Taunton, Mass.
C. D. Lamson, Boston, Mass.
W. A. Learned, Newton, Mass.
G. L. Manchester, E. Hampton, Mass.
D. Moore, Salem, Mass.
R. J. Monks, Boston, Mass.
G. B. Neal, Boston, Mass.
J. Porter, Greenfield, Mass.
C. F. Prichard, Lynn, Mass.
E. G. Pratt, N. Attleboro', Mass.
A. D. Perry, Quincy, Mass.
J. F. Rogers, Boston, Mass.
F. S. Richardson, N. Adams, Mass.
J. H. Rollins, Worcester, Mass.
C. S. Spaulding, Brookline, Mass.
J. Q. A. Spear, Boston, Mass.
W. H. Snow, Holyoke, Mass.
C. F. Spaulding, Brookline, Mass.
W. Tarbell, Waltham, Mass.
A. W. Tarbell, Waltham, Mass.
D. D. Tilton, Newburyport, Mass.
J. R. Todd, Natick, Mass.
R. B. Taber, New Bedford, Mass.
G. Wood, New Bedford, Mass.
L. W. Wells, Roxbury, Mass.
W. A. Wood, Boston, Mass.
Z. M. Jenks, Woonsocket, R. I.
S. G. Stiness, Pawtucket, R. I.
W. A. Stedman, Newport, R. I.
A. B. Slater, Providence, R. I.
O. Gilmor, Norwich, Conn.
J. P. Harbison, Hartford, Conn.
E. C. Learned, New Britain, Conn.
C. H. Nettleton, Birmingham, Conn.
F. C. Sherman, New Haven, Conn.

On motion, the minutes of the last annual meeting were approved of as published in the Am. Gas Light Journal.

Applications for and Election to Membership.

The Secretary reported that the Directors had received applications for membership from Messrs. Edward. Hassett, Supt. Beverly (Mass.) Gas Light Co.; Robt. J. Long, Asst. Supt. Salem (Mass.) Gas Light Co.; C. M. Jewett, Asst. Supt. Clinton (Mass.) Gas Light Co.; Wm. Anderson, Supt. Marlborough (Mass.) Gas Light Co.; and Wm. Badger, Supt. Concord (N. H.) Gas Light Co.; and that the Directors recommended that the above-named gentlemen be voted for by the Association.

On motion, the Secretary was instructed to cast the ballot of the Association in favor of the election of the applicants. The tellers (Messrs. Stedman and Sherman) subsequently reported that the ballot had been cast in favor of the gentlemen, and they were thereupon declared by the President duly elected members of the Association.

Invited to Witness the Proceedings.

Mr. Stiness—We have with us to-day in Boston a number of our friends who are directly interested in what we may term our kindred industries, and I move that they be invited to take seats in our convention. The motion was agreed to, Messrs. Stiness and Leach being named as a committee to inform the visitors of the action taken.

In response to that action of the Association the following gentlemen were escorted by the committee to seats in the Convention:

Messrs. Starkes Whiton, E. T. Rowell, and F. E. Barker, who compose the Massachusetts State Gas Commission;

Also, Messrs.

Bush, J. S.	Floyd, J. R.	McDonald, W.	Sanderson, C. E.
Corbett, C. H.	Graeff, G. W., Jr.	Page, G. S.	Wood, A. C.
Down, W. H.	Hayward, T. J.	Rowland, T. F., Jr.	White, W. H.
Davis, F. J.	Kreischer, G. F.	Stanley, I. N.	Weber, O. B.
Edwards, G. B.	Langford, J. T.	Sprague, C. H.	Waldo, C. H.
Flemming, D. D.	Lenz, E.	Sprague, P. W.	Waldo, J. A.

The Guild Tenders Hospitalities.

The Secretary read a communication from Mr. E. G. Pratt, Secretary of the Guild of Gas Managers, tendering the members of the New England Association, during their stay in Boston, the hospitalities of the Guild's rooms.

On motion, the invitation was accepted, and the thanks of the Association tendered therefor.

Responses and Regrets.

The Secretary announced that, by direction of the President and Directors, many invitations to attend the present meeting had been extended to prominent gas men throughout the country. Many responses to these invitations had been received. The Secretary then read letters which had been forwarded to him by Messrs. Emerson McMillin, Columbus, Ohio; J. B. Howard, Dubuque, Iowa; A. M. Smith and A. Strecker, New York city; Wm. Helme, Phila., Pa.; A. E. Boardman, Macon, Ga.; H. N. Babcock, Syracuse, N. Y.; G. G. Ramsdell, Vincennes, Ind.; and R. Spencer, Burlington, Iowa.

PRESIDENT'S ADDRESS.

The President then delivered the following inaugural address:

Gentlemen of the New England Association:—Another year has passed, and we meet here to note its events; to relate to each other and the Association our experiences, our pleasures, and our trials; to compare results, and gain new strength and encouragement for the year to come.

I find that we have on our list of membership to-day the names of two honorary and ninety active members. The report of your Treasurer, which will be laid before you, will show that there has been received during the year the sum of $342.46. The payments during the same period have been $284.41, leaving a balance on hand of $909.80. Of this amount the sum of $700 is on deposit in the Derby Savings Bank, of Derby, Conn., bearing interest at the rate of 5 per cent. per annum.

At a meeting of the Directors, held on the 1st day of January, 1887, it was voted "That the Treasurer be authorized to make such changes in the investment of the funds of the Association as he may think proper, under the direction of the President." In accordance with the above authority, and under the advice of the President, the Treasurer has transferred the funds of the Association to the Derby Savings Bank, as already stated.

At the last annual meeting of the Association it was voted "That the matter of holding a semi-annual meeting of the Association be referred to the Board of Directors." In accordance with that vote, at a meeting of the Directors subsequently held, letters were read from the members of the Board not present, and all the members present and absent (with one exception) voted orally or by writing in favor of omitting the semi-annual meeting for that year.

There has not during the year, so far as my knowledge extends, been any radical change or progress made in the manufacture or distribution of gas; but rather a steady and healthful growth. From all directions come reports of decrease in cost of production and distribution, occasioned in part by the introduction of new and improved furnaces and machinery for the manufacture and preparation of the gas for the consumers; and an increase of consumption, largely resulting from lessened selling price. In this connection it is well to note that, in a very large majority of cases, the gas companies, not only of New England but almost of the entire country, are to-day selling gas, of a greatly increased illuminating power, at about one-half the price charged ten or twelve years ago, and yet are paying a fair rate of dividend to their shareholders. All of which, I think, is greatly to the credit of the efficient managers of gas works.

During the last few years a large demand has arisen for gas for domestic purposes—that is, for heating and cooking. This being in large measure a "day" business, requiring no additional storage room, mains or service pipes to convey it, meters to measure it, or clerical force to make out, deliver, or collect the bills, is an exceedingly profitable part of the business, and enables gas companies to reduce the selling price for all their output and yet earn a fair percentage on their capital. This part of the business—which, with some companies, now amounts to from 15 to 20 per cent. of their entire output—deserves close and constant attention and encouragement.

Quite a step forward has been made during the year in the mode of consuming gas by the use of regenerative burners (notably the Lungren, and others of that general type) for illuminating large spaces, or where a strong and steady light is required. They are very much in advance of any burner heretofore introduced; and their rapid and general introduction, for the

benefit not only of the gas companies but largely so of the consumer, should be earnestly encouraged. Your special and earnest attention will be called to this important subject by a paper prepared and to be read to the Association by one of its members—one who is fully qualified to treat the subject in the exhaustive manner it deserves.

Other papers have been prepared on different subjects by various members, and they will be found to be of much practical value. I trust all of them will receive, as they deserve, your close and earnest attention, and full and complete consideration in the discussion which will take place on their merits.

Considerable attention has been given during the year, by various members of the Association, to the important subject of the utilization of residuals, in order to increase the income from the sale and disposition of coke, tar, and ammoniacal liquor; and, I learn, in some cases with marked success. I am decidedly of the opinion that much more may be accomplished in that direction; and that we may largely reduce the percentage of fuel used under the retorts, obtain a higher price for the coke and tar sold, and also receive a good return for the ammoniacal liquor—which latter has largely, heretofore, been allowed to run to waste.

Our thorough and earnest attention to this subject will, in my opinion, greatly assist us in solving the problem, which has for some time been agitating the minds of many of the members of this and other associations, of how to sell gas at *one dollar* per thousand cubic feet, and yet earn a satisfactory dividend for our shareholders. While on this subject permit me to add that the members of the New England Association must continue to occupy the "front rank" in regard to low prices. As the "parent" Association of Gas Engineers in this country, the eyes of gas men of the whole continent (as well as of the fraternity across the water) are upon us—noting our every action and advancement. They also are earnestly laboring towards the solution of the "dollar" problem. Let us not permit them to outdo us in their efforts, but continue to hold the advanced position we have so successfully obtained and maintained up to this time. A word for our encouragement on this point.

Many of the members present will remember a gathering of New England gas men, held in the city of Springfield, Mass., on the cordial invitation of our beloved (but now lamented) friend, George Dwight. Upon the entrance into the room (where all the others of the party were already seated around the hospitable board of our friend Dwight) of the last comer, he was greeted and toasted as the *Two* dollar man. In modestly returning thanks for the cordial greeting, and responding to the toast, he prophesied that within five years from that day there was scarcely a gentleman present who would be willing to admit that he was charging as much as two dollars per thousand cubic feet for his gas. How literally has that prophecy been verified! Nearly eight years has passed, and note how many gas companies in New England are to-day charging three-fourths of even the then toasted two dollar rate.

At the same ratio of reduction in price a very few years from this time will show a large proportion of at least the larger gas companies of New England, and all over the country as well, selling gas at the uniform price of *one dollar* per thousand cubic feet. Let us all do our part to hasten the arrival of that hoped-for day. Then, surely, will the gas manager's lot be a happy one—the grateful consumer alike with the happy shareholder calling down blessings upon his head. May we all live to share and enjoy the deserved happiness and blessings of such a delightful state of things.

The question of what action gas companies shall take in regard to the furnishing of electric light as a part of their business, is one that just now attracts a good share of attention. The proper solution, I apprehend, must be arrived at by each individual gas company, from its own standpoint and existing circumstances and surroundings. In regard to actual cost of maintenance and furnishing the light, I am of the opinion that very little information has been gained by outsiders during the year. If any of the members can give us additional light or information on this subject, I trust they will do so during the sessions of the Association.

A few of the members have made a new departure during the year by the introduction of a small water gas plant in their works, as an auxiliary or addition to their former facilities for making gas. I trust we shall be favored with the results, advantageous or otherwise, which they have obtained from the experiment. It has been thought by some of the members that the constitution of this Association ought to be amended so as to provide for the admission of associate members. It is well known to all that there are gentlemen intimately connected or acquainted with the business interests of gas companies, in the matter of furnishing apparatus and supplies, and who are well posted from observation in regard to the proper mode of building works and the management thereof, yet who are not practically skilled or engaged in the business. Such gentlemen, in my opinion, might well be permitted to become associate members, with the privilege and right to pay the usual initiation and yearly fee, and enjoy all the rights of active members, except those of voting and holding office. If an amendment to the constitution, providing for such membership, is presented for your consideration I heartily recommend its adoption.

Information has been received by our Secretary of the death of two of our members—Mr. Estes Howe, of Cambridge, Mass., and Mr. William C. Taber, of New Bedford, Mass. A committee to prepare a fitting and proper minute in relation thereto should be appointed.

I take much pleasure in bearing testimony to the thorough and efficient manner in which our worthy Secretary and Treasurer has performed the duties of the respective offices during the year.

Let us all, by our earnest and honest endeavors to promote, elevate, and perfect the business in which we are engaged, strive to deserve the good opinion of our friends of the profession at home and abroad; benefit the consumers of gas; continue to do justice to the shareholders in our respective companies, not forgetting that those in our employ have strong claims on us which must not be overlooked.

In conclusion, permit me to convey to you my grateful acknowledgements for the high honor conferred on me in being called by you to preside over your deliberations; and, asking your cordial assistance in the performance of my duties, let me express the hope that this the Seventeenth Annual Meeting of the New England Association may be looked back and referred to with pleasure and profit by every member.

Committee on President's Address.

On motion of Mr. Stedman a committee of three (Messrs. W. A Stedman, F. C. Sherman, and D. W. Crafts) was appointed to consider the President's address, and to report back to the Association, during the present session, their conclusions upon the particular points contained therein that ought to be acted upon by the Association.

Treasurer's Report.

The Treasurer presented and read the following annual report, which was, on motion, "received, recorded, and placed on file."

Charles H. Nettleton, Treasurer, in account with the New England Association of Gas Engineers.

1886.				*Dr.*
Feb 15.	Balance			$151 75
	Received dues, 1886	$120 00		
	" " 1887	150 00		
	" admission fees, meeting '86	10 00		
				280 00
	Interest from Charlestown Savings Bank	$29 50		
	" " Warren Inst. of Savings	32 96		
				62 46
	Charlestown Savings Bank	$300 00		
	Warren Institution of Savings	400 00		
				700 00
				$1,194 21
Feb. 18.	L. H. Humphreys, Prop. Narragansett House.		$341 00	
	Less dinner tickets	$147 00		
	Subscription	65 00		
			212 00	
				$129 00
Feb. 19.	J. A. & R. A. Reid, dinner tickets			4 50
" 24.	Elmwood Paper Box Co., badges			13 00
March 1.	The Shelton Printing Co			16 25
" 1.	The Derby Printing Co			9 50
April 22.	A. M. Callender & Co			45 00
June 23.	Postage, telegrams, etc., pd. C. H. Nettleton			8 93
1887.				
Feb. 9.	Charles H. Nettleton, salary			50 00
" 9.	The Derby Savings Bank deposit			700 00
" 10.	Postage and telegram			8 23
" 12.	Balance			209 80
				$1,194 21

Balance, $209.80. Permanent fund deposited in the Derby Savings Bank, of Birmingham, Conn., $700.

Birmingham, Conn., Feb. 12, 1887.

Charles H. Nettleton, Treasurer.

We hereby certify that we have examined the Treasurer's accounts and find the same correct. H. A. Allyn, Robt. B. Taber, } Auditing Committee.

Committee on Nominations.

On motion of Mr. Slater, the President designated Messrs. A. B. Slater, J. L. Hallett, E. G. Pratt, Ogden Gilmor, and W. H. Snow a committee to nominate a board of officers for the ensuing year.

REPORT OF BOARD OF DIRECTORS.

The Secretary read the following report from the Board of Directors:

The Directors report that the following papers have been presented to be read before the Association:

"The Effects of Reduction in Price of Gas," by A. M. Norton; "Some Thoughts on Purifying Gas by Oxide of Iron," by C. J. R. Humphreys; "Photometric Units," by R. B. Taber; "Candle Power and Illumination," by C. F. Prichard; "Naphthaline and its Cure," by E. G. Pratt; "Introduction of High Candle Power Burners," by F. S. Richardson.

They also report the following gentlemen for election to honorary membership in the Association:

Gen. A. Hickenlooper, Cincinnati, Ohio; Mr. George A. McIlhenny, Washington, D. C.; and Mr. Emerson McMillin, Columbus, Ohio.

The President remarked that probably the first action to be taken on the report should be in regard to the recommendations for honorary membership. He thought it fitting and proper that the New England Association, as the parent body, should from time to time add to its rolls by electing to honorary membership gentlemen who had distinguished themselves in the gas profession. He believed that those whom the Directors thus sought to honor well deserved such recognition, and trusted that the recommendation would meet with unanimous approval. He thought the Association would do credit to itself by complimenting the gentlemen proposed in the manner suggested, and then asked the pleasure of the Association in the matter of the recommendation. [The Constitution provides for the election of honorary members in terms identical with those applicable to the election of active members.]

On motion of Mr. M. S. Greenough, the Secretary was directed to cast the ballot of the Association in favor of the election to honorary membership of the gentlemen named in the Director's report. The Secretary subsequently reported the result of the ballot. The nominees were declared elected, and the Secretary was instructed to inform the gentlemen of their election. [Later on in the sessions despatches were received from the nominees acknowledging the honor conferred.]

READING THE PAPERS.

The President introduced the Hon. A. M. Norton, of Nashua, N. H., who read the following paper, entitled

THE EFFECT OF REDUCTION IN PRICE OF GAS.

What the management of the Nashua (N. H.) Gas Light Company has demonstrated with reference to the results of a reduction in price should be considered with certain local features. You might be inclined to attribute a large share of the results to changes in population and business, but there has not been any extensive addition of stores or manufactories to the city—that is, bearing any proper proportion to the change in the amount of gas consumed.

The population embraces a very large percentage of operatives, but their average income and condition do not especially favor gas lighting; and the corporation buildings occupied by these operatives accommodate no unusual proportion of the whole number. In fact we think the proportion must be rather less than the average of manufacturing cities. We have a very large percentage of foreign population, occupying small tenements too cheap for gas fixtures; and it is to be noted that our increase in population has been largely of this element.

Starting out with these facts we ought to be able to establish the connection between results and their causes. January 1st, 1880, the price of gas was $2.80 per thousand cubic feet, and the annual sendout was 11,644,950 cubic feet. On Jan. 1st, 1881, the price of gas was $2.50 per thousand cubic feet. The sendout for that year was 13,417, 410 cubic feet, or an increase, over 1880, of 15.22 per cent.

Jan. 1st, 1882, the price of gas was $2.30 per thousand cubic feet. The sendout for 1882 was 15,092,090 cubic feet, or an increase over 1881 of 12.48 per cent.

Jan. 1st, 1883, our price was $2.10 per thousand cubic feet. The sendout for the year 1883 was 17,058,500 cubic feet, or an increase of 12.36 per cent. over 1882.

Jan. 1st, 1884, our price was $2 per thousand cubic feet. The sendout for 1884 was 19,172,240 cubic feet, or an increase over the year 1883 of 11.80 per cent.

Jan. 1st, 1885, our price was $1.80 per thousand cubic feet. The sendout for 1885 was 20,717.400 cubic feet, or an increase over 1884 of 8.05 per cent.

Jan. 1st, 1886, the price of gas was $1.60 per thousand cubic feet. The sendout for the year 1886 was 24,800,560 cubic feet, or an increase over the year 1885 of 19.70 per cent. Thus it appears that in seven years we have increased the sendout from 11,644,950 cubic feet, in 1880, to 24,800,560 cubic feet in 1886.

The increase in meters has been from 550 to 800, or about seven per cent. each year. This shows that the increased consumption is not due merely to an increase in population nor in the number of consumers.

We are satisfied that our patrons appreciate the change; and the following extract, from the Nashua *Daily Telegraph*, published soon after our last reduction, and written without solicitation or personal interest of the writer, shows the public feeling towards us:

"In the superior business advantages which this city holds out to manufacturers our gas company is one of the most public spirited. It is about the only monopoly on the earth whose record shows repeated reductions in the interests of the consumers of its product. Its example is exceptional, signal, and altogether sensible."

It will be noted that our greatest increase in consumption occurred last year, during a part of which time our customers were being switched off by electric lighting. The increased consumption by those who wanted more light in order to compare favorably with those putting in electric lamps, and who consumed more gas solely on that account, would not probably equal the loss arising from changes to electric lighting, so that we find no adequate cause for the increased consumption save in the reduced price.

We are satisfied that the only way we can maintain the popularity of gas lighting against the improved lamps for burning oil, and the use of electricity, and yearly increase the consumption, is by putting the price low. Any other policy in our city, in our judgment, would be beating against the bars of fate, and would end in waste rather than growth.

Discussion.

The President—Mr. Norton has given us a very interesting statement of the results which attended the reductions in price of gas at Nashua. I trust that others present will give their experience in this connection for the encouragement of those who have not yet made such rapid downward progress in their selling rates. No doubt Mr. Norton will be ready to answer any questions that may be asked him.

Mr. Slater—I think, Mr. President, you have had as much experience in that respect as any other member of this Association, and we would all be glad to hear from you.

The President—Our Hartford experience has been quite similar to that of Mr. Norton. In 1874 or 1875, when our price had got down to $2.75 per thousand, we thought we were doing pretty well by the people. Our experience, much like that of gas men generally throughout the country, had been that we were earning a very good dividend for our stockholders, were trying to furnish a pretty fair light, and the people, as a rule, were pretty well satisfied; but about the time mentioned kerosene oil came to the front, and was being furnished at what we thought to be an abominably low price. The people seemed to be well satisfied with the price of oil, and enterprising dealers, taking advantage of the prevailing sentiment, introduced lamps that were well fitted to burn kerosene and obtain therefrom a very good light. As you all know, about the same time a very serious depression in the business interests of the country occurred, and people found great necessity for economizing. Finding that they could get along, by huddling around the table closely, with one kerosene lamp in rooms where they formerly had used a number of gas burners, they adopted the single lamp and cut off the gas. The result in our case was that a very large number of meters were sent from the houses and stores of our consumers back to the gas works. The meters actually came to us in wagon loads. Perhaps we tried to comfort ourselves by saying, they came in for repairs, or for repainting; but in the succeeding years we found abundance of time in which to overhaul them. Considerably over a thousand out of the five thousand then in use were returned. It finally seemed necessary, if we proposed to continue in the business of making and selling gas, that we should take a new departure; and we took it. Three months after we made up our minds to that effect we reduced our prices—first to $2.50, then to $2 per thousand cubic feet. The effect was that our meters, instead of coming back to the gas works, were being once more sent out from it. In three or four years our net output had decreased to about one-third of its former maximum volume; but when we reduced (1880) to $2 per thousand cubic feet, the tide began to turn, and from 60 odd million cubic feet yearly sales (the lowest point reached at $2 per thousand), our sendout has gone up regularly, year by year, as the price came down, from $2 to $1.90, then to $1.80, to $1.60, and $1.40, our present selling price. The gas sold private consumers in 1886 was about seven millions cubic feet in excess of any previous year in the history of our Company. That is practically the result of our reductions in the price of gas. The policy has led to the introduction of much better means for consuming gas, in the shape of improved burners and globes; and largely in the use of gas stoves for cooking and heating. We have now something over 1,000 gas stoves in use in our city. We find that these reductions in price have worked well for us; and I think you will all have the same experience. If you will introduce, or help to introduce, gas stoves, in connection with lower prices for gas, you will find a very large increase in the amount of consumption, and as the consumption increases, you will find that the cost correspondingly decreases—not so much in the item of manufacture as in the distribution, which latter is a very important item in the cost

of gas. The increased output requires no additional holder room, nor additional meters, nor increase of clerical force. We do not find that the people generally pay us less money than they did when the price of gas was at $2.50 or over per thousand; but they do use a greater quantity of gas, thus obtaining more light than formerly, and are much better satisfied than they were in the dark days of '75. The result summed up is that we can still earn a dividend with which our stockholders are satisfied, and that our consumers are also satisfied.

Mr. Stiness—I would like to ask Mr. Norton if his increase seemed to be derived from gas consumed for illuminating purposes; or did he have an increased quantity chargeable to the use of gas in stoves, or for manufacturing purposes?

Mr. Norton—We introduced, during the last year, a good many heating stoves, which may have had much to do with the increase shown. We did not introduce many cooking stoves until this year, but have been very successful with them. The use of gas for mechanical purposes has not increased in proportion to the gain made in the use for heating and cooking.

Mr. Taber—I believe Mr. Norton made reference in his paper to the effect that he found an obstacle to the increased use of gas in that a certain class of tenants would not pay for the gas fixtures. I would like to ask Mr. Norton if there really is such a difficulty; and if so, is it not our own fault that we cannot supply gas to that class of people? The New Bedford Company last year gave more attention to fixtures and lighting than it had ever done before; and our experience goes to show that, in the general opinion of the people, the cost of fixtures is quite a bugbear. We find it possible to put in grades of fixtures that are as cheap as any oil lamps obtainable. I noticed, when in Europe a few years ago, that almost all of the tenement buildings in England were piped for gas. The question occurred to me if it were not our own fault that we had allowed ourselves to think that gas was only for the richer classes; whether in this respect we have not made an error, and consequently have been compelled to keep up the price of gas. To my mind a great deal of money can be gained by the gas company undertaking to furnish the fixtures. Especially in view of the competition with electricity which is all about us, and with the electric lighting companies supplying their own fixtures, it seems to me advisable that gas companies should take the same stand, and supply not only the stoves (which we have been trying to introduce at New Bedford for several years), but also be ready to furnish the fixtures and to put them in—to make the contract, if necessary, to supply everything from the main to the burner. In very many cases this would save money to the consumer; and would give us the advantage of treating with the customer in a way that is sure to be very satisfactory to him. In regard to reducing the price, in New Bedford we attempted another scheme, which was to reduce the price for a given consumption. It has resulted very satisfactorily, although it developed a rather anomalous feature. We supply gas to the ordinary consumer at $2, with 10 per cent. off, or $1 80 net. We say to the consumer, "If you will use 4,000 feet we will sell it to you for $1.50 per thousand. You can readily calculate that, if you burn only 3,200 feet at the long price, you will have to pay very nearly the same as the one who burns 4,000 feet." This has caused some annoyance, but, in the main, has been satisfactory, and one of the results has been that they have commenced to use gas stoves.

The President—We would like to hear what experience Mr. Greenough has had here in Boston.

Mr. Greenough—One point occurred to me, after hearing that paper, which is this: I noticed that Mr. Norton's consumption increased regularly about 10 or 11 per cent., about as fast as he brought down the price of gas, until he got to the point where the gas was *cheap;* but when he got to a point where gas was obviously cheaper than other lights the consumption took a jump. I do not think, in reducing from $1.60 to $1.40, one could get the same proportional increase that would occur when reducing it from $1.80 to $1.60. To illustrate: If a man were selling at $3 and reduced the price to $2.50, I question very much whether he would get a material increase in consumption. Gas would still be a luxury, for people could light more cheaply with oil. If the reduction were from $2.50 to $2, it would still be a question whether he would secure a material increase. But if he reduced it from $2 to $1.50, or so that gas was obviously a cheaper light than oil, then he would find a very decided increase in consumption. I do not think, for instance, that we would sell materially more gas in Boston if we were selling it somewhat cheaper than we are doing to-day; but if we could sell gas at $1 instead of $1.50, we would at once bring it very largely into uses for which other fuels are now supplied. In that case I have no doubt our consumption would very largely increase; but I do not think that a reduction from $1.50 to $1.35 would materially increase the gas consumption over what it is at the present time. The point I wish to emphasize is this: After gas has dropped in price, or from being a luxury to an economy, the consumption will increase enormously, as is shown by Mr. Norton's paper; but with a moderate reduction, or one still leaving the price of gas where it is a luxury, there will not be any very marked effect upon the consumption. Such is the inference I should draw from Mr. Norton's paper.

Mr. Tarbell—We feel satisfied with the increase made in Waltham during the past 10 years, and we think it is largely due to the lessening of selling rates. Ten years ago gas was $3.70, and the amount used by private consumers aggregated about 3½ million cubic feet; but last year we sold nearly 10 million feet, to the same class of customers, at $2 per thousand. During that time we have increased the number of our meters from 400 to 700. My statement does not include gas sold to manufacturers, etc., for our entire yearly output is 20 millions.

The President—We would like to know what Mr. Hallett's Springfield experience has been, for he has been persistent, like some of his neighbors, in cutting rates.

Mr. Hallett—Last year we lowered our rate from $2.30 to $2, and our increase during that time was 7 per cent. From January 1st to 14th of February the increase was 12 per cent.; but I do not think the entire increase should be charged to the reduction, for we made quite an extensive increase in length of mains, and added a large number of meters. It is a fact, however, that—while our city has been growing, and we have year after year sent out more gas on that account—as we have increased the output we have felt it to be the best policy to reduce the price. No doubt a part of the increase came from the reduction in price, but not wholly. We are now selling gas at $2 per thousand, with 5 per cent. off to all consumers, and 10 per cent. discount where the annual bills amount to over $600.

Mr. Leach—Our experience at Taunton does not bear out the idea conveyed by Mr. Greenough regarding the effect of a slight reduction in gas prices. Last October we reduced from $1.50 and $1.75 to $1.45 and $1.65, and since then the increase has been over 16 per cent. It was somewhat marvelous to me, and I cou'd not understand it for a while; but upon examining the books I ascertained that almost the entire increase came from the domestic consumption, varying with individuals from 10 to 50 per cent., which showed that the slight decrease was accountable for the net result. I presume many of you have had a similar experience. We had, during the past year, at least half a dozen letters from people who burned gas very largely, begging us not to reduce the price of gas again. [Laughter.] They said the reduction did not lessen the size of their bills; but that is because the lower the price of gas the more of it they will burn. When gas is cheap the consumers are not so economical in its use as when the charge is high.

Mr. Tarbell—In Waltham our ordinary gain was about one million cubic feet per year after each reduction; but the last reduction (when we decreased from $2.50 to $2 per thousand) was followed by a gain of 1,600,000. That result seems adverse to the argument (used at the time) of those who were opposed to making a reduction of 50 cents per thousand. They thought it better to reduce from $2.50 to $2.25, and follow with a second reduction of 25 cents. The price, however, was cut to $2.00, and I think the gain was greatly increased thereby.

Mr. Slater—I see friend Wood, of Syracuse, N. Y., in the room. He is selling gas at a very low figure, and we would like to know what has been his experience.

Mr. Wood—I was and am here as a listener; but since I have been called upon let me state that our experience has been similar to that related by the other gentlemen. A reduction in price always resulted in a large increase in gas consumption. In 1880 we did sell some gas at $2.50 per thousand, but in that year we lowered to $2, and since then have gradually reduced until now we supply ordinary consumers at $1.50, and the city at $1.40 per thousand cubic feet. During the six years our increase in consumption has exceeded 100 per cent. Our prime object in reducing was to compete satisfactorily with kerosene oil, and at $2 per thousand gas can do so. The latter then becomes the cheaper light. Our day consumption for mechanical and domestic purposes, has largely increased. We are now sending out, between 7 A.M. and 5 P.M., from 25 to 28 per cent. of our total daily output. Previous to 1880 the sendout during like hours did not exceed 12 per cent. of the daily output. Since the advent of the electric light our consumption has also increased. A low selling rate for gas, so far as my experience with the electric light goes, causes the latter to act as an incentive to the increased use of gas—an educator of the gas consumer that impels him to have more light. We have consumers now using burners which take up 10 and 12 feet of gas per hour, who used to swear at the gas bills when they were using four and five feet burners. I think the electric light has largely aided in the increased consumption of gas, at least that is our Syracuse experience. In Cortlandt and Homer (little New York villages, where kerosene enters largely as an element in furnishing light) the increase in gas output that attends a reduction in gas rates has not been quite so marked. We sell gas there (one company supplies both villages) at $2, but the consumption does not increase in the same ratio that it did in Syracuse. Mr. Greenough doubts whether a slight decrease from the present selling price of gas in Boston would tend to increase the consumption. If I am correctly informed, in New

York city the reduction compelled by the Legislature to $1.25 per thousand has resulted in an enormous increase of output. In fact I believe the Consolidated Company has had hard work to supply the increased demand. I think the effect in Boston would be similar. If he should reach Brother Harbison's figures I think he would find a large increase as the result, and perhaps there would not be so many electric lights in Boston as is now the case. I think you will find that in small villages the percentage of increase will not be as great as that which has been observed in large cities.

Mr. Greenough—I should be very sorry to have the impression go out that I am not in favor of a reduction in the price of gas at Boston, because I think it is a duty which every company owes to the community it serves to sell gas as cheaply as it can, irrespective of the effect that any reduction may have in the way of increased consumption. The question of the reduction of price of gas in Boston has often been considered by the directors of the Boston Gas Light Company (in fact it is under consideration by them at the present time), and it is only the extremely involved condition of affairs in this city at the present time that prevents their taking action. What Mr. Wood says about the village of Cortlandt seems to bear out what I said—that when you have brought the price of gas down to the point where it is cheaper than any other light, its consumption will largely increase. If he could sell his gas in Cortlandt (which I do not suppose he can) at $1.50, his consumption would increase enormously; but in reducing it to $2 he has not yet arrived at the point where it is cheaper than any other light. In a prosperous community gas at $1.50 is at a price at which everybody who prefers gas can afford to burn it. I do not think he would sell much more gas at $1.25 than he would at $1.50. It is possible we might take away some business from the incandescent electric light people if we were selling gas 10 per cent. cheaper than we are to-day; but I do not think the increase would amount to very much, simply because the people who use the incandescent light do not use it from motives of economy. They will use it no matter what it costs, and therefore I do not think many of them would discontinue its use because the price of gas was reduced 10 per cent. Nevertheless, if we could put it so low that it could be used as a cheap fuel, then we would see an enormous increase in its consumption. Mr. Wood instances the New York companies. He must remember they had their gas at $1.75, and that a reduction of 50 cents per thousand feet makes quite a difference. I think that $1.75 for gas is high in a city of the size of New York.

Mr. Copp—I have had some experience, in a small way, in the matter of increasing consumption of gas by reducing its price. My first experience was secured in Plymouth, where a reduction from $5 to $4 per thousand was followed by a large increase. Since then, by gradual steps, the price has been brought to $2.50 (which is a low figure for that place, where the annual output is something like 4 million cubic feet), yet the increase in consumption has been very small; in fact no increase in output followed the last reduction. Still, such happening does not count against the principle of cheap gas, for the lack of increase may be charged to the electric lighting competition in that town. The electric light company supplies about 21 of our former gas consumers, and their 7 street lights supersede 19 gas lamps. In spite of all we have been able to about hold our own, and therefore we believe an increase has followed the reduction, although the same does not show on our books. On the other hand, at Exeter, N. H. (it is a small place), a phenomenal increase followed an apparent but not an actual reduction. There the price of gas a year ago was $3.75 gross, with 75 cents off for prompt payment, and when we determined to make the bills out at $3, flat, the consumers seemed to think that we lowered our rates, for we have had nearly 25 per cent. increase in consumption. Perhaps, though, the increase may be also partly accounted for from the fact that last year we had a sort of contest with electricity. During the progress of the row a hearing was had before the Selectmen, at which some hundreds of our citizens appeared. I blew the "gas horn" as best I could, and the matter terminated in our favor. Somehow or other the people feel as if the gas company had helped them out, and they in turn feel like helping the gas company. We told the people that if they would increase their consumption we would reduce the price, and they seem to have taken us at our word. Whether the consumption will continue to increase when we reach the $2.50 mark another year will show. At Rockland, Me., we have had a similar experience. We there reduced the price at one time from $4.50 to $3, and had a very rapid increase. Since then the increase has been small, although we have reduced the price to $2.75. We have had little or no increase of late; but that is on account of the stagnation in business there. When business is good they will burn gas; when it is poor they discontinue the gas and burn oil.

Mr. Cushing—I have only bare facts to present. Our price is now about as low as that of any company around us, and we are probably doing as well as any of our neighbors. I cannot say exactly what increase we have had during the present year; but we have been creeping up in spite of—perhaps I might better say by the *help* of—the electric light. We have largely increased our consumption by the introduction of heating and cooking stoves. This last year we made about 170 million cubic feet, and hope to make more as we go along.

Mr. Allyn—I had not the pleasure of listening to Mr. Norton's paper; but I can say that our Cambridge experience has been very similar to that reported by the other gentlemen. We are now enjoying the luxury of an electric light plant, established about three months ago. It has relieved us, so far, of the care and trouble of about 150 of our street lamps; but, notwithstanding that fact, we at present show an increase of about one million cubic feet per month, which, in our case, represents an increase of about 10 per cent. When we made our last reduction we had a President who never wanted to make a move without having figured out in dollars and cents just what the result would be. A reduction of 25 cents represented a falling off in receipts of about $25,000 per annum, and, making a pretty liberal allowance for an increase in consumption, the best figuring he could make seemed to prove that our receipts would be about $12,000 less than those of the previous year. In reality, however, the receipts for the twelvemonth following that reduction were but $1,100 less than those of the former year, which proved that the people did appreciate cheap gas. We are now selling at $1.75 to private consumers, and at $1.50 to the city.

The President—I think Mr. Norton has reason to feel that he has done the Association good service in bringing this matter to our attention. I think the statements of the gentlemen, in relating their experience about the results gained by reducing prices, must be very encouraging to every member present Although I heartily agree with much that has been said on the subject, yet there are some things that I dissent from. It was very gratifying to hear Mr. Wood say he had a day consumption of from 25 to 28 per cent. of his make. I wish each member would bear that statement in mind, and carry that percentage home with him and compare it with his own figures—if he has a record of similar statistics. If he does not possess such a record, then let him at once begin to make a record of the gas sent out through the year between the hours of 7 A.M. to 5 P.M. I imagine some will be surprised at the showing, and at the way in which it will increase throughout the year. I had the pleasure of showing my consumption book to some gentlemen who visited me a month ago, and I then proved to them that during December, 1886, our day business equalled 21.56 per cent. of the entire output for that month, while in January it was a little over 19 per cent. I do not agree with my friend Greenough in the statement that, after we get gas down to $1.50, a further reduction to $1 would not largely add to the consumption. I think it would. There is still in every city a large population unaccommodated with gas—or, rather, one that is not *served* with gas In my opinion this is because, even at $1.40 per thousand, gas will cost them more for illumination than the quantity of kerosene oil which they burn. In so speaking I do not mean that they obtain anything like as much light from the kerosene lamp as they would from gas; but in point of fact it costs them less to light their houses with kerosene oil than with gas at $1.40, simply because they do not have as much light. If they have gas burning they do not extinguish it whenever they pass into an adjoining room; but if they are burning kerosene they carry the lamp with them. They are more extravagant in the use of gas than they are with oil. I think that class of people ought to be reached, and can be reached more and more as we lower the price of gas. I also think we have a class of population that ought to be encouraged in using gas for domestic purposes. At $1.40 or $1.50 per thousand, gas will, in most cases, compete with coal for cooking, at $5 per ton. One of the great troubles encountered in this respect arises from the fact that there is not in the market a gas stove which can be bought at a price that average people feel able to pay, and I wish to emphasize that point. Some members of the gas fraternity have talked about making an effort to get out, on their own account, a stove that will meet the public want; and every manufacturing company engaged in the manufacture of these wares ought to fully appreciate the importance of this matter. I know their business, like the business of selling gas, can be largely increased; that they can make as much money by reducing the price of their stoves as we can by reducing the price of our gas.. They go together hand-in-hand and cannot be separated. I believe in large sales and small profits. I hope the gas stove manufacturers will feel the importance of this suggestion, for I believe this is one of the most important subjects before us to-day as gas engineers. I believe, in Hartford, for instance, that if we should reduce the price of gas to $1.25 (which has been talked about) we would increase our output the first year thereafter from 130 millions (it was that last year) to 150 millions. In fact I have no doubt of it. This gain would not accrue wholly from securing new consumers, but would in large measure be traceable to an increased use of gas by those who have and do now employ it for illumination but not for domestic purposes, and who would then use it for the last-named purpose. I do not quite understand Mr. Taber's idea as to gas fixtures. Does he think that gas fixtures ought to be put in at the Company's expense, or merely that the Company should do the work instead of allowing the same to be done by the plumbers?

Mr. Taber—The cost should be made as low as possible to the gas consumer.

The President—That the fixtures should be put in at cost?

Mr. Taber—For instance; a gentleman said to me the other day that it would cost him $50 to pipe his house, and $75 more to put in the fixtures. I offered to do the work for $75, and secured him as a consumer. That illustrates the drift of the sentiment of the people on that subject.

The President—It is a matter well worthy the consideration of gas engineers. Up to 10 or 12 years ago a general impression prevailed among gas men that all they had to do was to make and distribute an abundant supply of good gas, and then monthly or quarterly, as the case might be, to be at their desks ready to receive the money payment of their service; but competition has taught us all a pretty good lesson, for we find it is necessary to carry on the gas business after the manner of an ordinary merchant. We must look at every detail, not only of manufacture and distribution, but must also oversee its use and encourage its employment. I think we will all find that our day business, if properly supervised, will secure to us a large increase of income, and that our additional earnings in this division will benefit us greatly in our ordinary business as light purveyors.

Mr. Taber—Apropos of the President's remarks, I am to-day somewhat in doubt whether or not to consider that I have "a leak in my main." Recently I advertised that, at the present price of coal, gas was cheaper than that material for cooking purposes; and last Friday and Saturday (Feb. 11 and 12) our day sales increased about 15,000 cubic feet. Is that increase due to a broken main, or is it to be accredited to the gas stoves?

On motion of Mr. Stiness, a vote of thanks was passed to Mr. Norton.

Mr. C. J. R. Humphreys, of Lawrence, Mass., now read his paper entitled—

SOME THOUGHTS ON PURIFICATION OF GAS BY IRON OXIDE.

I am fully aware that I am asking your attention to one of those subjects which, by common consent, has been voted threadbare; and, therefore, what I may say must lack that interest which accrues particularly to new and novel things. However, I do not offer an apology for bringing the matter before you, because I feel that these old and threadbare subjects, so called, must be taken up and considered from time to time, otherwise we may pass and repass some obscure kernel of truth, the possession of which would be of great service to us in our everyday duties as gas managers.

There are two divisions of the subject to which I would direct your attention. First, the relation of iron purification to the removal of carbonic acid from the gas; and, secondly, its bearing on the extraction of the sulphur compounds.

Some two years ago I had the honor to read before the Boston Guild of Gas Managers a paper* on "The Effect of Carbonic Acid on the Illuminating Power of Coal Gas," and it may be well to reproduce here some of the figures then given. Particularly as some of the thoughts then presented were discussed on theoretical grounds, whereas now, in one important instance at least, it will be possible to consider the matter in the light of results obtained in our everyday work.

The experiments then undertaken showed that the gas, as manufactured at our works at Lawrence, Mass., contained, after it passed the iron purifiers, $1\frac{32}{100}$ per cent. of carbonic acid. A small purifier was rigged in the photometer room, and the gas tested by the photometer to ascertain the difference in illuminating power before and after passing through the small lime purifier. The following is an analysis of the gas prior to its passage through the lime:

Analysis of Lawrence Gas made March 28, '85.

	Per Cent.
Illuminants	5.42
Marsh gas	37.24
Hydrogen	48.68
Carbonic oxide	6.04
Nitrogen	1.30
Carbonic acid	1.32

An analysis of the gas after passing through the small lime purifier showed it to be free from carbonic acid. The tests may be briefly summarized as follows. When the gas was tested by the Argand burner the presence of this 1.32 per cent. of carbonic acid knocked down the illuminating power by 0.8 of a candle; and when the flat flame burner was used the loss was 1.03 of a candle. The calculations that were then made are based on the assumption that one bushel of lime would remove this 1.32 per cent. of carbonic acid from 18,000 cubic feet of gas. This was merely a theoretical assumption; it was, however, one of vital importance, because it formed the basis of the calculation, which showed a saving of a cent in favor of using lime instead of an enricher. During the last two years we have been able to test, by our daily work, the value of this assumed figure.

At the Lawrence gas works the gas, after passing through three boxes of iron, goes through two boxes of lime, and carbonic acid is tested for at the exit of these latter boxes with the same regularity that sulphuretted hydrogen is looked for at the outlet of the iron boxes. The gas is delivered to the lime purifiers free from sulphuretted hydrogen, so that this substance is left to deal alone with the carbonic acid; hence we have had an excellent opportunity to ascertain exactly what lime will do when it has to take care only of the carbonic acid. Strangely enough the figure which I assumed in my calculations two years ago has been found, by our two years' working, to be correct; for I find we have been using just one bushel of lime to 18,000 cubic feet of gas.

We come now to the second division of our subject, namely, the effect of iron purification on the removal from the gas of the sulphur compounds. You will remember that, theoretically, iron has no effect on the sulphur; but practically it does reduce the amount of this impurity very perceptibly. We who run gas works in the State of Massachusetts, and are forbidden to have more than 20 grains of sulphur in 100 cubic feet of gas, have been able to use iron with a considerable degree of safety; still at times, particularly in the winter season, we come unpleasantly near the statute limit. When occasionally the sulphur in our gas runs unpleasantly high I have felt annoyed that we did not understand the why and the wherefore of the matter, and were therefore unable to apply a remedy. It was in the hope that I might obtain some light on the subject that I recently turned my attention in this direction. Of course, where lime is used alone the rationale of the elimination of the sulphur is pretty well understood, and we can state the chemical changes involved by formula, for we know that the sulphuretted hydrogen combining with the lime forms the sulphate of calcium, which will, in turn, take up the bisulphide of calcium, making sulphocarbonate of lime; but with iron the case is not so satisfactory, for theoretically it has no action on the bisulphide of carbon. While I do not feel that I have as yet obtained much light on the subject, yet I lay before you the results as far as I have gone in the hope that someone else who has more time at his disposal than I have may take up the story and complete it. It was suggested to me that at my works the sulphur was not being removed in the iron boxes at all, but that it was being taken out by the lime. This seemed to me unreasonable, because the content of the lime boxes was—according to the time the material had been in use—either lime or a carbonate of lime, and those have no affinity for the bisulphide of carbon. However, to make sure of the matter, I had made simultaneously a sulphur test of the gas before and after the lime purifiers with the following result:

	Grains in 100 cu. ft.
After iron, before lime	15.51
After lime	16.94

These figures would indicate that the gas after it passed the lime contained more sulphur than before, but the difference is so small that I would attribute it to the variation which is so apt to arise in tests of this kind, and feel safe in assuming that the contained sulphur before and after the lime boxes was the same.

My next step was to have an analysis of the oxide of iron made, hoping to be able to determine what form the sulphur had taken therein. The result was as follows:

Analysis of Oxide of Iron from Lawrence Gas Works, made by Mr. C. D. Jenkins.

	Per Cent.
Sulpho cyanide of ammonium	9.70
Sulphate of ammonium	7.33
Free ammonia	0.13
Protosulphide of iron	14.70
Free sulphur	48.83
Insoluble residue, sand, etc	3.53
Water and organic matter, hydrocarbons, etc	15.78

The iron had been used for about two years. The sample which was tested was taken with great care, so as to insure a fair average. As soon as the purifier cover was removed a shovelful of the iron was taken from a dozen different parts of the top layer; these were thoroughly mixed, and a fruit jar filled with the mixture and hermetically sealed. Another jar was filled in like manner from the material on the lower layer. When the analysis was made the contents of the two jars were thoroughly mixed and the sample taken therefrom.

The large amount of sulpho-cyanide of ammonium is surprising, and would seem to raise the conjecture whether the ammonia is the agency by which the sulphur is removed. It is fairly open to argument that such reactions might occur here, while they would not take place—or perhaps not to the same extent—in a washer or scrubber; for the ammonia is in a more concentrated form, and is presented to the gas in a more thorough manner than would be the case in the best of scrubbers. The subject is an interesting one, and worthy of further investigation.

The combination of lime and iron purification offers many advantages, because when the two are thus combined we have much less refuse lime to

*See JOURNAL, XLII., June 2, '85, p. 289.

handle, and we get rid of the nuisance occasioned by the smell from the lime, for when this material is used alone for the extraction of carbonic acid, it comes from the box in the form of an odorless carbonate of lime. The two forms of purification blend happily together; it would therefore be well if we could make ourselves thoroughly acquainted with the chemical reactions involved, so that we can act intelligently. I trust these few remarks may act as an incentive to some one to investigate the question with that completeness its importance merits.

Discussion.

Mr. Greenough—If I understood Mr. Humphreys, the result of his calculations was that it cost him more to use his lime purification than it did to put in the amount of enricher necessary to bring the gas up to the requisite candle power.

Mr. Humphreys—My calculations showed it would cost one cent less to use the lime to take out the carbonic acid than it would to make up that candle power by the use of an enricher. Of course, the expense depends upon what it costs to put the candle into the gas. I calculate on one candle, although the tests on the argand burner show only a loss of eight-tenths of a candle, while the flat-flame variety shows something more than a candle, yet I felt that the flat-flame indicated the guide to be taken, as that burner is the one used by the community. We make gas to light people's houses, and not to experiment with in the photometer room. If some one else can enrich his gas cheaper than I can, why of course that is another matter.

Mr. Allyn—Did I understand Mr. Humphreys to say that he passed his gas through two lime purifiers? Or, did he use them alternately, one at a time?

Mr. Humphreys—I have six purifiers in all; four of them worked on one centre seal are for the iron, three of them being constantly in use. From that centre seal the gas passes to two purifiers in which lime is used exclusively. At the outlet of the last iron box we test regularly, of course, for sulphuretted hydrogen, and do not let it pass through. At the outlet of the lime box we test regularly for carbonic acid, and we do not let any pass that point into the holders, at least none that will show in the regular lime test.

Mr. Allyn—How do you operate when you want to change the lime in one of these purifiers?

Mr. Humphreys—Then we run for a day on one box.

The President—If any member has had experience in the use of iron and lime together, or separately, we would like to hear from him.

Mr. Greenough—I think this paper affords an admirable example of the advantage which would come to the Association if we could get beforehand some synopsis of the papers which are to be read at our meetings. I had no idea what Mr. Humphrey's paper was to be. Had I known, I could have produced some figures which would either have sustained or disagreed with his; because, in one of our works, we are taking out the sulphuretted hydrogen first, and the carbonic acid afterwards, while in the other works we are running a set of oxide of iron purifiers singly. Now we find that in the case where we purify by oxide of iron alone, we must use very nearly half a gallon more of oil per thousand feet of gas to keep the gas at the same grade as the gas in the works where we take out the carbonic acid by means of lime. As to some of the results given in Mr. Humphrey's paper, or as to what he found could be actually done in taking out the carbonic acid, I do not know but that I could produce some figures of my own that would show quite differently. I should have been happy to have done so, had I known to what we were to listen. I think the paper is a very interesting one, but there ought to be some additional figures given here to-day on the subject. I have no doubt there are gentlemen present who can substantiate his figures.

Mr. Allyn—Like Mr. Greenough, I labored under a misconception as to what Mr. Humphrey's paper was to be. I thought he would give us the result of his use of oxide of iron for purification; that he would tell us how much he purified per bushel; how long the oxide lasted, etc. In that understanding I brought along some figures regarding the results obtained at our Cambridge works, so that I might compare them with his, but now I fear my figures may seem foreign to the subject.

The President—We shall be glad to hear them read.

Mr. Allyn—I commenced the use of oxide of iron one year ago last April, and have continued its use up to the present time. Our boxes are 20 feet square. We started by placing 500 bushels in each purifier, and I confess we had considerable misgiving about it at the outset. Located as we are, at the home of Harvard College, we have a good many professors and students who are continually experimenting on the gas, and so I did not know but that I should be brought up before the authorities to give an account of myself, yet so far I have escaped. I confess my experience as to the loss of candle power does not correspond with that of Mr. Humphrey's. I used almost precisely the same amount of oil, for an enricher, in the first year that I had used when using lime for purifying the previous year. The record of the State Inspector showed there had been a slight increase in candle power. Whether it was on account of employing the oxide or not I am unable to say. The results obtained were these: In the first month, 2,478 cubic feet per bushel were purified; in the second month, 6,738 cubic feet; in the third month, 4,959 cubic feet. The average for the first quarter was 4,725 cubic feet; for the second, 17,150 cubic feet; for the third, 11,243 cubic feet; and for the fourth, 11,861 cubic feet. In the following year the average for the first quarter was 10,936 cubic feet; for the second, 8,142 cubic feet; for the third, 5,180 cubic feet; and thus far the present quarter has averaged 3,320 cubic feet. My idea is that our first lot of oxide has perhaps seen its best days, and my intention is to use it about two months longer, and then get a new supply. The actual expense for purification, including cost of the sponge, and of the labor expended on it for the time it has been used, averaged a trifle under one cent per thousand cubic feet. The expense for the lime purification used previously (we had to cart the lime over a long distance to and from the purifying house) averaged about two cents per thousand cubic feet.

Mr. Humphreys—Does that one cent include material?

Mr. Allyn—Yes; it covers all expenses.

The President—Does Mr. Allyn remember what his lime cost per bushel?

Mr. Allyn—We made it ourselves from shells, and it cost us about six cents per bushel.

Mr. Prichard—I think the question whether we should use iron or lime in purification is largely one of comparative cost. At our works I find that by using iron alone I can save 1½, possibly 2 cents in purifying each 1,000 cubic feet of gas. I am badly situated to obtain cheap lime, while the reverse is the case in regard to iron. Mr. Humphreys seems to be situated just the other way. We thought in the past that it was cheaper for us to allow the carbonic acid to remain and enrich the gas by using 1¼ gals. of oil to 1,000 cubic feet of gas; but within the past year I have become somewhat converted to the other theory. I find that by the exclusive use of iron the amount of sulphur contained in the gas is quite plainly increased. In the State Inspector's report for the present year you will find, by examining the list of companies named, you can easily ascertain those that use iron and those that employ lime in purification. It is there very plainly marked indeed; and further, you can also ascertain the ones that make use of a mixture. In the last year I used about four inches of lime in each box, and find that, although all the carbonic acid is not extracted, it is nevertheless brought to a very low point, or to where the quantity present does not affect the candle power at all. As illustrating the efficacy or completeness of purification by the two methods, I have here analyses of gases respectively purified by iron and by lime alone. The analyses were made within a few weeks, and the quality of the gas was the same. In the lime instance the sulphur present is shown to be 6.2 grains; the iron sample shows a sulphur content of 15.4 grains. The ammonia content, in the first case, is 9.8 grains, in the other it was 3.7 grains. If we desire to improve the quality of our gas, it seems to me we must use lime entirely, or else a "happy mixture" of lime and iron.

Mr. Humphreys—I agree with Mr. Prichard, that taking out the carbonic acid or remedying it by the use of an enricher is entirely a local matter. One method may be good policy in one place, while a different course must be pursued in another situation. There are but two points in connection with my paper that seem worthy of attention. One is with regard to amount of work, practically, that a bushel of lime will do when left to deal alone with the carbonic acid. In a great many works lime is used on the trays with the iron, and there you do not have a chance to see just how much work that lime is doing; but in Lawrence using those two boxes for the carbonic acid alone we were able to see exactly how much gas a bushel of lime will purify, which, from two years' practical running, we find to be about 18,000 cubic feet. That is not a theoretical figure, but the theoretical figure assumed by me two years ago happened to agree with it. The second point of importance is the analysis of the iron. We have very few analyses of spent oxide on record, because in looking for such I only encountered one, made in 1850, I think; I believe, therefore, the analysis given in my paper is worthy of a place on the record. Showing, as it does, a large amount of sulphocyanide of ammonium, it raises the interesting question whether or not the ammonia, acting as a sort of go-between, has taken the sulphur out. I hoped by bringing the matter before you that some one who has more time than myself to investigate the question may take the story up, and show whether or not there is anything of value in the theory. I certainly intend, if possible, to investigate the matter further. I think we ought to know what we are doing, for if we are to use iron purification, and expect to take out the sulphur by it, we should make ourselves perfectly familiar with the theory of the practice.

Mr. Stiness—I would like to understand just what Mr. Humphreys means by the term "iron purification." What sort of sponge material does he use?

Mr. Humphreys—I do not apprehend there is very much difference between the different brands. What we use at Lawrence is really a mixture. We had on hand at one time considerable quantities of American iron sponge and English oxide, but in the course of working with them for years they became pretty well mixed up. In fact, we may now say the material consists of a mixture of English oxide and common sponge.

Mr. Prichard—It may be interesting to know that in the Lynn works, after removing the carbonic acid, so that only 1.95 per cent. was left, a bushel of lime purified 42,000 cubic feet and reduced the carbonic acid to a half of one per cent.

The President—Did you use your lime in the same box with the iron?

Mr. Prichard—We used it in the lower tier.

The President—That was using the lime before the iron, instead of after, as Mr. Humphreys did.

Mr. Neal—Will Mr. Humphreys state the relative size of his boxes?

Mr. Humphreys—We have four purifiers at work on iron. Two of these are 20 feet square, the other two being 10 feet by 16 feet. The two boxes used for lime are 10 feet by 16 feet.

Mr. Jones—A small item in reference to purification at the South Boston works may be interesting to the fraternity. We had much trouble during the last two or three winters with our lime purification. The lime caked in the boxes and we were unable to account for it. So far as we could judge, the lime was neither too wet nor too dry; but at the outside we were unable to purify over 3,000 cubic feet of gas per bushel of lime. We have opened boxes when the lime was almost the same as when put in fresh. Recently we mixed in about ten per cent. of green sawdust with the lime, preparing the material on the floor of our lime house. To be more precise, we used 12½ bushels of loose sawdust to every 130 bushels of lime; our boxes being 14 feet by 18 feet. Since that time we had no trouble from back pressure, and have been able to purify our usual amount of gas per bushel of lime. The gas in our holders has also contained considerably less ammonia than it did before we used the sawdust. I cannot account for it except upon the theory that the sawdust may be slightly acid.

Mr. Pratt—I would ask Mr. Jones if he does not attribute the caking of the lime to the manner in which he sprayed naphtha into the purifiers. I had the same trouble when I used it in that way.

Mr. Jones—Since we used this comparatively small amount of sawdust mixed with the lime we have continued to spray naphtha into the purifiers. We thoroughly believe in that practice. We have had no trouble from naphthaline since we commenced that practice.

Mr. Neal—Will Mr. Jones explain his method of spraying the naphtha?

Mr. Jones—I read a paper* on the subject two years ago, and hardly think it necessary to go over it again; but to answer the question let me say I simply put the naphtha in a can (using about 20 gallons to 130 bushels of lime in a box 14 by 18) and spray it through the plug holes under the covers of the purifiers by the aid of a common Johnson pump and a fine spray-nozzle, so as to divide the naphtha into as small particles as possible. I do this just before changing the purifiers. I then put the cap on the box, and change without blowing out any air. The naphtha carbonates the air in the box. We have no trouble from reduced candle power, and, in addition, have no trouble whatever from naphthaline.

On motion of Mr. Taber, a vote of thanks was tendered to Mr. Humphreys for his paper. The Association here ordered a recess, to terminate at 3 P.M.

First Day.—Afternoon Session.

Report of Nominating Committee.

Mr. Slater, from the Committee appointed to present a list of officers for the ensuing year, reported the following list of nominees, and recommended their election:

President—John P. Harbison.
First Vice-President—Hon. A. M. Norton.
Second Vice-President—R. B. Taber.
Directors—Geo. B. Neal, W. A. Stedman, C. F. Prichard, H. A. Allyn, and F. S. Richardson.
Secretary and Treasurer—Charles H. Nettleton.

Election of Officers.

On motion of Mr. Stiness, the report of the Committee was accepted, and the Secretary was instructed to cast the ballot of the Association for the election of the nominees. With Messrs. Stiness and Wood acting as tellers, the Secretary cast the ballot for the Association as directed, and the tellers subsequently reported a unanimous vote for the gentlemen named by the Nominating Committee.

The President—In accordance with the report of your tellers, I declare these gentlemen duly elected to serve as officers of the Association during the ensuing year. In behalf of myself, whom you have again honored by selecting me as your President, I desire to return my sincere thanks.

The President here introduced Mr. E. G. Pratt, of North Attleboro', Mass., who read the following paper on

THE TREATMENT OF NAPHTHALINE.

Having been called upon by the Secretary of our Association to contribute something to the success of our present meeting, I should feel that I had neglected a duty did I not comply with his request. And yet, in looking over the field, there seems to be no subject upon which one can give expression that has not already been discussed to such an extent, that the mere mention of the theme causes the listener to wonder what more can be said upon that question from which he can derive any information.

Many of the papers furnished at our meetings would be of little value in themselves were it not that there were points brought out in the discussion following the reading thereof from which we derived considerable benefit. Although, in this I do not expect to advance any new ideas, I shall endeavor to give you the results obtained in practice of what, to many, may still remain a theory.

Naphthaline (C^{10} H^{8}), the study of which has given rise to the most numerous and varied researches, from the double point of view of the causes of its production and the means of avoiding it.

It was for the purpose of finding out, with some degree of intelligence, whether or not my own ideas and experience would be borne out by that of others, that I mailed to some 35 managers of works a list of questions, to be answered and returned in season to tabulate. Some were what I wanted, others very incomplete, while about one-third neglected to return answers at all; so that with the press of business on my own part I have not been able to get them into shape.

The questions asked, however, were as follows:

1.—Have you been troubled with naphthaline during the past year; and to what do you attribute the cause?

2.—What distance does gas at your works have to traverse from hydraulic main to station meter?

3.—Temperature (F.) at inlet of condenser?
4.— " (F.) " outlet of "
5.— " (F.) " " washer or scrubber?
6.— " (F.) " " station meter?

7.—If you have been troubled with naphthaline, where has it shown itself first—at the works, or in the street mains and services?

My object in doing this was to find out, if possible, if at works where there was trouble from the deposition of naphthaline the conditions were not relatively the same; that is to say, that the condensing apparatus was inadequate, or the distance traversed by the gas on its passage from the hydraulic main to the station meter too short to allow of a gradual cooling from, say, 190° to 60°. I must admit that I was considerably surprised to find out, from returns received, that it was an exception where the manager reported he had been troubled with naphthaline during the year.

The conditions, as to distances, condensing surfaces, etc., hardly appear to be the same in any two localities; but still there is very little complaint from naphthaline.

The use of gas-oil or naphtha, either as an enricher, or sprayed into the purifiers, seems to be the panacea for this so-called evil. And this leads me to say, that from my own experience, while gas-oil or naphtha may serve as a solvent in the one case and a drier in the other, I do not believe their use for the purpose of getting rid of the disastrous effects of naphthaline will be found so satisfactory as that of which I am about to speak.

At the works under my charge there has been more or less trouble from naphthaline, until within the past year; and during the period of four years, through the Fall and Winter months, we have used either gas-oil or naphtha as an enricher. Our coal is not distilled at as high a temperature, probably, as at those works having regenerative furnaces, but at as high a heat, perhaps, as it is possible to attain in an ordinary setting. In the distillation of coal at high temperatures there is effected, at least, a partial distillation of the tars, the first cause of the production of naphthaline, for it is well known that, in the manufacture of naphthaline for commercial purposes, it is prepared from the distillation of tar. If, therefore, in the distillation of coal at high temperatures, naphthaline is produced from a partial distillation of the tar, it is certain that, in order to avoid any injurious effects therefrom, the separating of the gas and tar after leaving the retort must be obviated by causing the cooling process to be as slow as possible. In other words, to secure perfect condensation, the gas should be left for the longest possible time in contact with the tar.

With this in view, though I had what was considered ample condensing apparatus for a works the size of ours, I changed the arrangement of things in such a way that the gas, instead of going directly from the hydraulic main into a multitubular condenser, as formerly, now makes a complete circuit of the retort house by means of an 8-inch pipe strapped to the inner wall of building. In this way I secured an additional distance from hydraulic main to condenser of 186 feet, thus making the total distance to be traversed by the gas before reaching the station meter equal to 796 feet.

It is unnecessary for me to say that with this change my trouble from naphthaline entirely disappeared, though its effects became apparent in another way, and that in an increase of yield and illuminating power. Formerly the unsteadiness of the yields from day to day was noticeable, but now both yields and illuminating power are remarkably uniform.

The temperature of the gas in this 8-inch pipe (Feb. 14, 1887), taken directly after charging three retorts in a bench of 6's, and the

---

* See Journal, April 16, 1885, p. 199.

only bench being charged on this date, commencing at hydraulic main, and read at intervals of fifty feet, was as follows:

At hydraulic main	146° F.
50 feet distant	112° "
100 " "	101° "
150 " "	93° "
Inlet of condenser	85° "
Outlet of condenser	68° "
Outlet of washer	60° "
Outlet of station meter	55° "

Thus it will be noticed that there is no sudden reduction in the temperature of gas as there was when the condensing apparatus was more closely connected, and located in another room. It might be well here also to mention the fact that, before this change was made, every time a purifier was emptied there was found a quantity of tar and heavy oil in the bottom of the box that had to be removed; but now the bottoms of boxes are perfectly dry, except occasionally, when in a box that has been filled with iron (we use part lime and part iron sponge), a deposit of heavy oil will be found, which oil is probably a portion of that injected into the retorts as an enricher.

It will, no doubt, be argued by those members who have become wedded to the use of gas-oil or naphtha as an enricher, that, if by their use a double object is secured, and they not only raise the illuminating power of their gas, but trouble from the deposition of naphthaline is avoided, what is the need of giving such particular attention to condensation, as long as the same results are secured? If this were the case, and we had no other incentive, I am afraid the real importance of naphthaline would soon be lost sight of; for instead of being an evil, as we have been wont to term it, properly handled, I believe it to be one of the greatest benefits to the gas maker.

To me this question is of great interest, for I believe that with our improved methods of carbonizing coal at high temperatures, the matter of cooling the gas properly is an important factor. There is no doubt, probably, in the minds of many of us, that the time is not very far distant when, from a pound of our best coals, six feet of 20 candle gas can be produced, and that without any other enricher than what may be found in the proper understanding of naphthaline and its allies.

Discussion.

Mr. Stiness—I am so fortunate as not to have had fall to my lot many of the ills common to gas men. For a number of years I have not been troubled to any extent with naphthaline. The policy marked out by Mr. Pratt is one I have acted upon for such a length of time, that I can most fully agree with the sentiments of his paper. I have never fully believed that the deposition of naphthaline was entirely due to the use of naphtha or gas-oil, and I do believe it is by reason of this method of slowly passing the gas along to the condensing apparatus, and having the latter apparatus ample, that we not only receive a benefit from what nature has placed in the black diamond, but also experience a benefit in the non-formation of naphthaline. In our Pawtucket works I have always carried the pipe on the side of the retort house as far as possible before it reached the condensing apparatus. Although it is true that every gas works must be "a law unto itself," and that what operates well in one may not do so in another, yet my experience leads me to believe that those who are afflicted with naphthaline will receive great benefit by adopting the plan mentioned. I was one of those who received a circular from friend Pratt in regard to that matter, and was compelled to reply that I could not give him any information with regard to the solution of the problem, because of the fact that I was not troubled with naphthaline. I believe an examination of my works will demonstrate that I run at about as high heats as those of the majority of gas works in New England, and so I do not think the presence of naphthaline can be attributed to high heats; but, on the contrary, I apprehend if I were to suddenly cool my gas down from 120° to about 60°, I should be very much troubled with naphthaline.

Mr. Nettleton—During the last Fall, for the first time in several years, the works with which I am connected had some trouble from naphthaline. It came at the time when the hot scrubber, that we used for several years, was thrown out. As soon as the hot scrubber was connected the trouble disappeared at once. Singularly enough, a large works near New York was troubled in the same way, and under the same conditions; because with the reconnection of the hot scrubber the trouble disappeared at once. That is a mere incident, but tends to corroborate the statement of Mr. Pratt—that you need a hot scrubbing surface to avoid the deposition of naphthaline.

The President—I would like Mr. Jones to state how much hot scrubbing surface he had in his retort house before the gas got to the condenser, and whether that has been changed since he began to spray with naphtha?

Mr. Jones—Our works at South Boston are very favorably arranged. We have a long retort house, and the gas passes along the whole length and across one end of it—say a total distance of 150 feet; from thence down and into the exhauster room, through the exhauster; next through the condenser and scrubbing apparatus—whose surface is ample—and thence to the purifiers. It is fully as favorable as the modern works Mr. Pratt described. There is plenty of hot scrubbing surface before the gas reaches the exhauster.

The President—And yet previous to spraying with naphtha you had trouble with naphthaline?

Mr. Jones—Yes. The cooling of our gas between the hydraulic main and the centre of the purifiers was very gradual. It is at 125° F. when it enters the exhauster, at 80° when it leaves the condenser, and at about 75° when it leaves the first scrubber, and reaches the centre of the purifiers at a temperature of 55° to 60° F. Thus you see the gas is not subjected to any sudden shock in passing through the various pieces of apparatus.

Mr. Brayton—One time, or right after we introduced a steam-jet exhauster in the works at Brockton, I discovered what naphthaline was, and could make any quantity of it. I had always supposed the exhauster should go next to the hydraulic main, and consequently placed this steam-jet as near to that point as possible. The immediate result was that my condensers became clogged from end to end, and it was only by continual and constant vigilance that I was able to keep my works in operation. Very much to my surprise, the naphthaline was all deposited within the apparatus, none reaching the inlets of the holder—not a particle ever being found outside the works while the steam-jet was in use. When the jet became too small for the capacity of the works, a rotary exhauster was introduced, and in consequence the length of pipe that the gas passed through was very much increased. After that I was not troubled with naphthaline either inside or outside of the works. I think the increase in the length of pipe is a step in the right direction. How far it is necessary to be carried of course I am unable to say.

On motion of Mr. Jones, the thanks of the Association were voted to Mr. Pratt for his paper.

Mr. C. F. Prichard, of Lynn, Mass., read the following paper, entitled

CANDLE POWER AND ILLUMINATION.

About a week ago matter which I had gathered together for this paper was suddenly destroyed by accident, and no time has since been found to repeat the tests, or to re-write many notes; therefore, this must appear incomplete, and is not what I hoped or intended to present.

That a great discrepancy exists between candle power and illumination there seems to be no doubt. You will find men beside you who will assert confidently that a 16 candle coal-gas flame will illuminate a given room better than an 18 candle water-gas flame. You can find plenty of people, some of whom are engaged in the manufacture of both kinds of lights, who will state that a 16 candle gas flame is much better in illuminating effect than a 16 candle incandescent light. Few will deny that a 1,000 candle power gas light produces a much more satisfactory light than a nominal 2,000 candle power arc light, and it is not uncommon to hear expert electricians declare that they do not believe a person can honestly tell, from the illumination produced, whether the arc light is one of 2,000 or one of 1,200 to 1,500 candle power. Yet the photometric tests show these differences, and so many tests have been made that we cannot question the reliability of the statements.

If, however, we admit that there is any truth in the statements of discrepancy between candle power and illumination, we become forced to take the ground that at best the photometer is not a measurer of illumination. The saying that where there is smoke there is apt to be fire is true, and the prevailing opinion of the discrepancy of candle power and illumination must have some foundation in fact.

Some years ago I remember assisting in preparing a church to be lighted by means of standards among the pews carrying six gas-jets each. By my advice, the opal globes coming with the fixtures were not used, for we wished to be economical in the lighting, and I had all the text-books on gas and gas making at my back in saying that 60 per cent. of the light was lost by using an opal shade. Contrary to my expectations, the illumination was poor, and, one of the members having suggested a trial of the effect of the globes, when the soft diffusive light filled the church, my confidence in some experimenters, as well as in the photometer, received a severe shock.

Inquiry shows that in this case, as in many others, the discrepancy existing is not so much in the photometer as in our method of using it. In use the horizontal rays emitted by a flame are compared with the horizontal rays emitted by a candle, and we call this candle power, not considering the fact that rays are also emitted at every conceivable angle—above, below, and around.

One of the laws of light is that rays emitted obliquely from a surface are less intense in proportion as they are more inclined to the surface which emits them. Therefore, by this law, the rays of light from a flame, as they leave the horizontal and approach the vertical, leave the maximum measured candle power and approach the minimum of zero; also, in flat flames there is a difference of about 10 per cent. between the candle power measured from the flat side of the flame and the candle power measured from the edge. Again, in the case of the opal globes cited before F. W. Hartley found and published the fact that the light thrown downward from flat flames in opal globes was actually increased some 20 odd per cent. when measured inside of a cone whose apex was the flame and whose angle was about 40°, depending upon the size of opening of the globe, while with argand burners the light was decreased. From these examples it is seen that when we speak of a light of a certain candle power, we have not measured the total amount of light emitted from the flame, nor a quantity proportionate to the total light emitted, nor have we in the case of different lights measured even the same fraction of the light emitted. Therefore, we see that this measured candle power has almost no bearing on the illuminating value, and it is quite possible for two lights to have exactly the same candle power, measured horizontally, but to be really emitting an entirely different amount of light, and consequently have a different illuminating value.

To obtain an approximation to the illuminating value of a light, it would be necessary to measure the light emitted in a number of directions, above, below, and around, and from these calculate an average candle power. This, when done, has been aptly termed the spherical candle power, and comes much nearer being a measure of the illuminating value of a light. Besides this error in the use of the instrument—an error almost impossible to avoid in its present form—there are at least two other considerations which cause a variation.

Size and Color.—If the compared candle and gas flames were of the same size the observed candle power would be correct, so far as size is concerned; but as the size of a flame is increased so is the number of rays which are emitted obliquely increased, and these rays do not assert their true value upon the disc, but become more and more in error as this flame grows larger, and the large flame, of the same measured candle power of the smaller one, will be found, practically, decidedly the better illuminator.

A comparison on a photometer, using an opal globe for the larger light, will convince anyone that this is quite a sensible error.

Still, another advantage of size, and one well recognized by manufacturers of incandescent lights, as shown in their variously coiled filaments, is that size adds greatly to the diffusibility. The smaller the light and the more it approaches a point, or even a line, the sharper become the shadows and the darker do they appear by contrast—producing that effect so well shown in the arc light, and so foreign to true illumination.

The differences in the color of light, although not recognized to any extent by the photometer, nevertheless affect the illumination produced considerably. The natural daylight, composed of certain fixed proportions of red, orange, yellow, green, blue, indigo and violet, is the standard upon which we must base our ideas of color. Unless the light thrown upon an object has about this proportion of colored rays, it appears unnatural, and is not illuminated in the true sense of the word. For instance, we cannot illuminate a blue object by throwing upon it a red light; its outlines and form can be distinguished, but its color appears black. And so with any other color, or any combination of colors, we produce results in illumination varying greatly.

Commencing with the particles in a flame heated to a low temperature, light is produced composed mostly of red rays; as it becomes heated higher, orange is added; and, finally, the other colors of the spectrum—the proportion of red to blue or the other colors always varying—and the eye's comparative estimate of a series of colors must always depend upon the light which illuminates it.

The heavy flame of the checked burner has much more red than that of the unchecked one; the unchecked burner has more red in proportion than the argand; and the argand more than the regenerative burners, or the albo-carbon light, because the temperature per unit of light-giving surface is less, and the colored rays emitted are of the lower colors.

Similarly, a 16 candle power gas, being less rich than an 18 or 20 candle power one, may exceed it in temperature per unit of flame area, and so produce a white light by having less red in proportion to its total light.

In the past, while in charge of a small plant near Boston, I have often been complimented upon the quality of our light, which, I was assured, was much better than Boston's. No doubt others here have had the same experience. One I knew to be 16 candle power, the other 20; but so long as we supplied a sufficient volume of light through larger burners and at higher pressure, the difference in quality appeared quite prominently, and the illumination produced was in reality better.

The effect of more pressure on a burner is very noticeable. The flame whitens at once, and the light is unquestionably better, although obtained at an expense of quantity.

The two seem to be convertible to a certain extent. A burner near the smoking point will afford more light than one with an excess of pressure; but the latter will afford a much whiter light, and one which is more pleasing to the eye. Certain burners now upon the market owe not a little of their popularity to this cause. Beside this, I am not sure but what the blue portion of the flame, previously considered of no value, is of great importance in affecting the quality of the light.

Discussion.

The President—As we have another paper (by Mr. R. B. Taber, of New Bedford, Mass.) on a kindred subject, we will now listen to it and then discuss them jointly.

Mr. Taber—Mr. Prichard and I were endeavoring to find out what Mr. Boardman meant by his experiments, as stated in his paper* read before the American Association. We each broke two chimneys over it, and neither found any satisfactory results. My only purpose in presenting this paper is in the hope that, as Mr. Prichard and myself agreed, in searching after a particular thing, the Association will go a little further in the premises, by correcting me at his expense, or him at my expense, or both of us by your superior wisdom. What I have to say reminds me very much of the story told of a fond parent, who, shouting to her friend across the street, desired to know if her little boy, who had been sent out in the mud half an hour previously, had yet got across; and the reply was that she had not seen him yet. I have floundered about in this subject very much as that boy did in the mud, and have not yet found solid ground, for the whole atmosphere of photometry, as far as I can scan it, seems shrouded in darkness.

Mr. Taber then read his paper on

UNITS OF PHOTOMETRY.

The entire atmosphere of photometry seems clouded in the vagueness of ancient barter. The Western definition (quoted with such approbation) seems to be, "Granted that the weight of the pig equals the weight of the stones; well, guess the weight of the stones!" In this day of keen competition, when intensity and luminosity have values, and are bought and sold as such, there should be, one would think, some convergence of opinion on this fundamental topic amongst gas engineers; but any examination, even the least, satisfies one of the empirical nature of the law, and the inaccuracies and errors creeping in in the examination of such a delicate subject. The very purpose of the act is largely indefinite and uncertain. A small luminous object of uncertain composition, with a consumption and height of flame dependent on the untwisting motion, absolutely uncontrolled, of a twisted thread, is made a unit of measurement of other bodies, luminous under other conditions, and often of vastly superior proportions. The very term candle power stands for the likeness of nothing existent; in fact hardly capable of imagination, since no one supposes that the light of 18 candles would behave like that of one Sugg's argand, or 2,000 like that of the electric arc.

And, to create still further distrust, the French Committee, in June last, gave M. Le Roux 800 francs as a reward for a "useful" essay on the inaccuracy of the formula (now 150 years old) of the "inverted squares of the distance," etc.; and although Dr. Krüss, of Hamburg, comes to its rescue, in the *Journal fuer Gasbeleuchtung*,† the very Doctor himself admits that with quite different degrees of brightness an open flame much distended cannot be accurately measured, without taking into account the factor dependent upon the relation of the cosines of the angle of incidence. The same Dr. Krüss has gone yet further, and demonstrated the necessity of some hitherto unexplained allowance for increase of length on the bar as the objects are more luminous; thus giving to a photometer of 20 candles 106.8 inches—an increase of 30 per cent. over the photometer of 12 candles.

---

*See JOURNAL, Jan. 3, 1887, p. 7.
†See No. 35, 1886.

Mr. Sheard, in the English gas journal issues of last summer, adds further confusion. By his published tables the same stored gas, tested by bar and differential photometers, gave a constant rate on the differential, and rates varying 20 per cent. in the bar photometer results. And yet no one who has ever used them will call a differential photometer anything other than a relative test; in no wise can it be called a measure of light.

Again, if I continue in my iconoclasm, I have never seen any mathematical formula for applying the corrections of either the gas or candle consumption. The increment in the candle power between three and six feet consumption is so great that a manifest error is committed if any large deviation is made from the required consumption; and hence the tradition of our faith makes necessary a new test under such circumstances; but (and this is to me a source of regret) while the gas may not vary two points in 500 a candle may vary two grains in 20, and this error be multiplied largely into the result. And, again, in the matter of the discs; on which side of the dead spot will you place the true reading? Is it a success of photometry to read the figures, and then guess half a candle? The proposed search for a photometer unit, it seems to me, must be into an accurate measure, which no ordinary observers, or one observer at different times, can necessarily use for exact results expressed in terms of a unit of light.

Now, if Mr. Dibdin, in his subterranean cave in London, with a quadriform photometer, gas being at the centre, and pentane, Methven slit, candle and Keats' oil lamp, respectively, at the four extremities, can be supported by four bright-minded, intelligent men, there is reason to think one unit, at least, can be permissibly obtained. Obviously, Violle's standard, in its inconstant melting point of platinum, will never obtain in common use. Herr Altenecк's acetate of amyl is another; and one can but believe the candle and carcel are used because they can be used, almost as a matter of necessity, with no value except as a relative unit without claim to exactitude.

Again, photometry, as it is now practiced, takes little record of colors; indeed, all the laws relating to their effect on the disc are new. Besides the observation, the effect of the differing refrangibility of the diffuse rays, photometry has little or no heed to this cause of disturbance, although this must sooner or later be a subject of keen competition, since upon it depends the subject of luminosity and intensity, hitherto concealed in the similarity of the colors of candle and gas. The subject broadens out into the relationship of these two factors, divergent in their effect, but confounded in the minds of many—a relationship amounting to the entire nullification of the one in the creation of the other, as when a gas flame is lost in the luminosity of a translucent shade. It is therefore a desideratum to be sought—some photometric unit of value of both these properties of light—as illustrated in the South Foreland Lighthouse experiments, where gas and oil were found penetrating a mist at 1,400 yards, while the much larger electric light could only penetrate 100 yards further.

This whole subject comes within the province of the physicist, and not of the gas engineer, I will allow; but I find consolation in hoping that there are among us those capable of grasping the question, and carrying it to a solution. And to still further define our subject, the need of a photometer is the need of an apparatus to be an accurate measure, giving constant results, expressed in terms of a light of a certain color. We may all see the difficulty in controlling these conditions; yet it is none the less true, as I said before, we sell our goods by this measure, for practically, to a gas engineer, the subject of photometric units is valuable to solve the question of the best manufacture of his gas. The question often recurs, "Can the photometric value be expressed in the terms of any or all the different elements entering into the composition of his gas?" Every gas engineer's daydream is for that day to arrive when, by the addition of this or the breaking up of that hydrocarbon, he may increase the little known effects of purifiers and scrubbers. It will then be a question of an algebraic formula, where a mixture of (a) illuminants, plus (b) marsh gas, plus (x) hydrogen, plus (y) nitrogen, and a little (oh! so little) naphthaline, equals the required candle power. For a help to the determinations of a, b, x, y, etc., I have had transcribed a copy of the analysis of the gas in our city, taken twice a week (over a period of six months) by our chemist, Mr. Gifford, and I have added thereto the candle power obtained and the specific gravity of the mixture.

ANALYSIS OF NEW BEDFORD GAS.

Date.	Bromine Illuminants.	CH_4.	H.	CO.	Candle Power. Bar.	Candle Power. Jet.	Specific Gravity
Dec. 28, 1885.	3.78	25.5	54.2	9.	19.	18.5	.414
Jan. 1, 1886.	3.58	26.2	51.9	8.6	18.6	18.8	.412
" 7, "	3.87	30.7	44.9	9.	18.2	18.5	.410
" 11, "	3.52	28.8	42.7	9.4	18.3	18.2	.408
" 18, "	3.57	30.87	43.67	8.4	17.7	18.2	.421
" 25, "	3.59	23.34	48.42	8.11	17.9	18.	.400
" 28, "	3.98	21.74	61.44	8.9	18.9	18.	.405
Feb. 1, "	3.79	26.33	53.83	8.4	18.5	17.5	.420
" 4, "	3.98	21.	55.99	10.4	17.15	17.5	.409
" 8, "	4.	23.04	54.04	9.3	17.16	17.5	.406
" 11, "	3.59	24.69	54.49	9.6	17.28	17.	.405
" 15, "	3.29	26.02	52.62	9.	17.58	17.	.438
" 18, "	3.48	25.62	50.66	9.1	16.82	16.5	.418
" 25, "	3.38	25.22	53.92	9.5	15.18	16.5	.412
Mar. 1, "	3.5	28.34	50.09	9.	17.77	16.5	.415
" 4, "	3.61	26.23	52.25	8.58	18.	16.8	.395
" 8, "	3.58	25.13	54.13	7.8	17.7	17.	.404
" 11, "	3.68	30.16	48.59	9.1	17.49	16.5	.425
" 18, "	4.59	25.59	51.18	8.8	16.3	17.	.421
" 22, "	4.40	25.49	51.59	8.79	16.7	16.5	.419
Apr. 1, "	4.48	16.87	60.14	9.4	18.71	17.	.406
" 5, "	4.68	26.77	48.13	8.6	19.4	17.3	.418
" 12, "	3.57	24.16	50.56	8.64	18.5	17.5	.420
" 15, "	5.19	28.54	45.36	9.1	19.	17.8	.415
" 19, "	4.09	29.52	50.62	8.02	18.56	18.	.415
" 22, "	3.96	27.28	51.25	9.41	16.88	17.	.405
" 26, "	3.90	26.27	49.71	9.53	17.39	17.	.408
" 29, "	5.08	28.43	50.91	9.5	18.66	17.	.420
May 6, "	4.39	26.36	53.28	9.3	18.23	17.5	.420
" 10, "	4.69	27.79	48.28	9.31	18.6	17.5	.415
" 13, "	4.39	26.41	49.97	9.6	18.7	17.	.422
" 20, "	4.28	27.11	60.96	8.9	18.4	17.5	.430
" 24, "	4.98	28.05	48.73	9.2	18.46	17.5	.405
June 7, "	4.29	27.37	50.27	8.8	17.	17.5	.427
" 17, "	4.28	29.99	48.33	9.8	17.9	17.	.430
" 24, "	4.19	24.46	54.90	9.7	16.79	17.	.420
" 28, "	3.98	26.85	49.83	9.8	15.6	16.5	.420
July 8, "	3.79	29.64	50.72	8.6	17.63	16.5	.400
" 12, "	4.18	25.63	54.57	8.8	17.91	16.5	.405

I make no further apology for the tables other than they are true, as comparative results for the period covered, and, as such, can be maintained. It is, of course, easy to make a few cursory deductions: but I think no one cares to express his judgment at once, or off-hand. A notable feature, certainly, is the relation of illuminants, determined by bromine condensation, to the reading of the bar—quite as noticeable as the simultaneous indifference of the specific gravity. For instance:

		Candle Power.	Spec Gravity.
A low bromine condensation	(3.38) gives . . .	15.8	.412
A high "	(5.19) " . .	19	.415
An intervening "	(4.40) " . . .	16.7	.419

A constant bromine gave equal results with two mixtures:

(1) 30.9 CH_4 + 43.7 H + 8.4 CO—spec. gravity .421
(2) 25.1 CH_4 + 54.1 H × 7.8 CO— " .404

One might almost fancy in this case that the increment of CH_4 was balanced by the loss resulting from CO.

I am, however, at present entirely unable to account for some of the resultants in this essay of an epistle. It is difficult, without much thought, to grasp the subject. Why, for instance, when bromine and marsh gas are constant, should the photometer fall one-half of a candle, with an increase of hydrogen and a decrease of CO? But an increase of CH_4 was apparently able to overcome a loss of illuminants, if supported by a similar falling off in CO.

The effect of CO is plainly for evil. In one instance an increase, from 8.8 per cent. to 9.7 per cent., in a gas equally rich in illuminants, marsh gas and hydrogen, made a loss of 1.1 candles; and this is supported in another less striking instance.

Constant candle powers, to come back to our subject, are made the play of large and small quantities of marsh gas and hydrogen, and are apparently more or less dependent upon the quantities of illuminants and CO.

In any case, then, there is no such thing known to scientists as a photometric unit. The attempt to standardize a gas by its candle

power—the same problem seen from our special point of view—is complex and intensely interesting; but, to say the least, difficult. As, however, it may be probable that a gas may be synthetically produced for a certain end, that end should be clearly defined; and perhaps I may hope a discussion may be provoked which shall result in the appointment of a committee, to be a committee on Photometric Standards of our Association, endowed with sufficient funds to verify the present advances in photometric research; and to report to this body from time to time as accurate standards may seem to have been obtained.

Discussion.

The President called on Mr. Humphreys to open the discussion.

Mr. Humphreys—I think the papers are very interesting, but the subject is one that we can hardly discuss off-hand—at least, speaking for myself, I must admit I do not feel like so discussing it. No doubt there is a difference between illumination and candle power. The point was raised in October last, at the meeting of American Association, that if candle power does not mean illumination, then the whole law with regard to the diffusion of light is erroneous—I think either Mr. Prichard or Mr. Taber touched on that subject, but I would like to hear from them further with regard to it—that is to say, if candle power does not mean just what we have always thought it meant, is not our notion with regard to the diffusion of light altogether wrong? I would like to hear from these gentlemen further on this point.

Mr. Prichard—My idea is that mere candle power has nothing at all to do with the amount of illumination produced. As stated in my paper, it is quite possible for one light to emit double the amount of total rays from different portions of its surface, and yet not emit the same amount horizontally. We may say that a bull's-eye lantern will emit, in a certain direction, 16 candle power, but in another direction it will not emit anything at all, yet a gas flame placed by the side of it will emit 16 candle power in the same direction that the lantern does, but the gas flame will also send out rays in every other direction as well. Of course, we know that the gas jet gives much the best illumination, and my illustration, of course, was in an extreme case. The rays that issue from a flame vary in illuminating capacity, but they do not all vary in the same way, consequently the total illumination in a flame is entirely different from its candle power.

Mr. Taber—I would like to ask Mr. Humphreys what he understands by "candle power?" I do not understand anything at all by it. As said in my paper, you may put 18 candles upon a table, and they will have, as compared with a gas flame, neither the same diffusive power, nor anything like the same luminosity. The term "candle power" has grown up out of our indifference to the subject, rather than from anything else. If we knew what we meant by candle power we might define it. It seems to me that the introduction of arc and incandescent electric-lighting will teach us what it is. As Mr. Prichard says, a 16 candle power incandescent light is not the same as a 16 candle gas flame; nor has it the same properties.

The President—I wish Mr. Lamson would give us the benefit of his investigations on this subject.

Mr. Lamson—I have tested a good many gases, but hardly think I am competent, on the moment, to state whether we should entirely give up the use of candle power as a measure of light. I do not know any better way to measure light than to measure it horizontally; and I think it would be difficult, at the present time, for anyone of us to suggest a better way. There is no question that the amount of light delivered from any gas or electric-light flame is entirely different (when taken horizontally) from what it would be if taken by spherical measurement in a dozen different directions. I remember, when we first had arc lights in Boston, they claimed 2,000 candle power for them. Some few experiments were made by the State Inspector with regard to the illuminating power of the light, but the results of his experiments did not tally with the figures given by the electric light people. Although we know that there are a great many inaccuracies in such a method as the measurement of the horizontal rays of a candle burning a certain amount per hour, yet I think we shall have to stick to the candle power measurement for the present.

Mr. Taber—Are there any members present who use any of the other standards—as the Methven, the pentane, or the acetate of amyl?

Mr. Greenough—The Methven—yes. I will say, that, so far as the Methven standard is concerned, we have used it, and nothing else, for several years. We find it to be a more satisfactory test than the candle, more easily regulated, less liable to change of any kind, and practically agreeing exactly in color with the flame with which it is compared. Mr. Prichard made one suggestion, among others, that particularly attracted my attention, when he said that when he knew he was making 16 candle gas, the quality of that gas was compared at the expense of gases which he knew were richer. That may be true, but I do not think it agrees with my own experience in the matter. That is to say, if, for any cause, the candle power of our own gas deteriorates below the 19 candles at which we try to keep it, I notice at once the smaller amount of light-giving power possessed by it; and the public notice it also. So that, as I would infer from his statement, we should give more satisfaction if we made a 16 candle gas than we should if we made a 19 candle gas.

Mr. Prichard—Perhaps you do not apprehend what I intended to convey.

Mr. Greenough—I understood you to say there was an advantage in giving a white light over giving a yellow one, and there is no doubt that a whiter light is given by the poorer grade gases than is ordinarily given by the richer sorts. If you burn the richer gas properly, of course you can get a white light out of it. I suppose it is easier to burn a poor gas satisfactorily, than it is a good gas. The inference to be drawn would be that you get more satisfaction by giving a 12 candle gas (as in Paris) than by giving a high grade gas (as in London), and I think that some people prefer the former.

There is another thing to which my attention has been drawn, and that is this matter of the analysis of gas, presented by Mr. Taber.

It is a very curious and interesting set of figures that Mr. Taber has presented to us, where I do not see any inference that can be legitimately drawn from those figures, except, possibly, as he suggests that the presence of carbonic oxide, beyond a certain quantity, is a detriment to illuminating power; and that has been already practically determined by Mr. Hinman, the State Inspector.

I think it beyond question, that over and above the presence of a small quantity, carbonic oxide in gas serves to deteriorate its value instead of helping it. I notice that when these analyses figures of Mr. Taber are added up they do not aggregate 100 per cent.

Mr. Taber—The nitrogen is omitted.

Mr. Prichard—I do not see any carbonic acid here.

Mr. Taber—There is practically no carbonic acid in our gas after purification.

Mr. Greenough—Would there be eight or nine per cent. of nitrogen?

Mr. Taber—Yes.

Mr. Greenough—I thought there might be some other hydrocarbons besides those which are given.

Mr. Taber—No; those are all absorbed by the bromine, except the marsh gas.

Mr. Greenough—I should have said, from the experiments made daily by me for many years (although they have been abandoned for the last few years) with condensation by bromine, the candle power would follow that more closely than it seems to bave done in the New Bedford instance; but, of course, these are the results of actual experiments, and as such are entitled to more weight than my recollection of what my own experiments showed. We have not yet learned from either of these gentlemen how they fared in their efforts to parallel the results obtained by Mr. Boardman, further than that they had some broken chimneys. I trust that they will give a more extended account than that, because I think it only needs something in that direction to make these two papers the most interesting ones we ever listened to in this Association.

Mr. Taber—The first time I tried the experiment with a student chimney the gas gave a candle power of 19.44. With an ordinary argand chimney it gave 16 candles. In the second experiment the results were very nearly the same, consequently I did not feel like pursuing it any further.

Mr. Prichard—In my experiments I could find no difference whatever—the results were practically identical as between the two burners, burning the same flame. I made a number of tests, and had others make them, but could see no difference in the results.

Mr. Greenough—There is another question I would like to ask Mr. Prichard. What is his judgment with regard to the comparative illuminating power of 16 candle water-gas and 16 candle coal-gas?

Mr. Prichard—I think the coal-gas flame would have a slightly larger area of flame; and, therefore, would be a slightly better illuminant.

Mr. Allyn—To follow out the point that Mr. Greenough touched upon, I think it would be interesting if he would state whether he has noticed any difference in gas where Albertite was used as an enricher, as against gas enriched with naphtha or oil.

Mr. Greenough—This whole question of the color of gas has come up within the last year or two; and in view of the new studies in photometry, and the new things to compare our light with, I have simply to trust to my recollection in the matter. We used Albertite coal during five or six years, in fact, until the mine gave out. Then for a time we used cannel, but in the last 18 months and a half we have used, practically, naphtha almost altogether. I do not think there has been any very great amount of variation in the color of the gas. For a time last Fall we gave up the naphtha, and used up some cannel that we had on hand, and I do not think there was any perceptible difference in the color of the gas. Certainly, no notice was taken by anybody as to a difference in color. Possibly Mr. Wood can give you a better answer about this than I can.

Mr. Wood.—I do not think there was any material difference in color when we dropped the use of naphtha and substituted cannel for it, on account of complaints that burners were stopping up, and it was thought that the change might remedy the difficulty. We have used no Albertite during the past year.

Mr. Greenough—We dropped cannel a year ago and used naphtha, but this last Fall we ran on cannel for about a month. There was a good deal of complaint at one time (as Mr. Wood has said) in one part of the city, that the burners kept stopping up; and as it was the first year that we had employed naphtha in any large quantity, we thought it might possibly come from its use. So we abandoned it for a fortnight, and went back to cannel to see if it had any effect. The substitution did not seem to have any effect on the burner difficulties, and the latter trouble afterwards disappeared—for the same unexplained reason that a great many other things happen.

The President—How much naphtha do you use?

Mr. Greenough—In our North End works (where we purify with lime) we used about one-half gallon of naphtha to each 1,000 cubic feet of gas; but at Commercial Point, for the reasons given this

morning, we find, in order to get the same grade of gas, we have to use nearly half a gallon more per thousand; thus we use from three-quarters to a gallon of naphtha for every thousand feet of gas we make.

Mr. Sherman—As our honorary member, Mr. Thomas, has some very decided opinions with regard to the comparative illuminating powers of coal- and water-gas, I would like to ask him for his views thereon.

The President—We shall be pleased to hear from Mr. Thomas.

Mr. Thomas—I have had for some time back very decided opinions in regard to candle power and illumination. A series of experiments made by me many years ago, in order to determine what volume of light could be obtained from one of the best descriptions of kerosene lamps, caused me to become satisfied over the question. A careful test on the photometer of the oil lamp employed showed its light to possess an illuminating value of 12 candles; but in testing the same oil lamp in comparison with a gas burner consuming five cubic feet per hour, working on 18 candle power gas, it was conclusively shown that the gas burner evolved an illuminating duty far in excess of that developed by two of the oil lamps. This, I submit, proved that candle power and illumination were widely differing things. A good practical method of determining the volume of light being emitted by either a gas or an electric light, is to turn your back to the light source, and then, while gently receding from it, note how far you can go and yet be able to read ordinary print without difficulty. Prof. Morton, in some of his experiments, found that so-called 2,000 candle power arc lights in reality gave a light which varied between 500 and 1,100 candles. I think if the intensity of this light had been measured by a photometer, it would have largely exceeded the maximum figure given. In an experiment made at one time a rated 1,000 candle power arc light, measured as accurately as was possible by the photometer, was put in a retort house, between a double stack of benches. Between other benches, similarly situated, a triple ring Sugg's argand burner was placed; the latter gave, by the photometer, a light equal to 196 candles. It was there shown satisfactorily that the gas flame gave the greater amount of illumination; that objects were more readily seen by its aid than was the case in the area illuminated by the electric light. In the city of New York, where so-called high and low (according to the photometrical tests) gas—running from 36 to 19 candles—is used, I do not believe that an observer, on seeing the gas as ordinarily burned in the stores and houses, could determine whether he was looking at the 36 or the 19 candle power article. My individual impression is that the 19 candle gas will afford the better illumination, although the photometer might try to prove the contrary.

Mr. Taber—On listening to the remarks of Mr. Thomas, it occurred to me whether it may not be with light as it is with heat. Take an ordinary small heater, and the heat becomes intense in proportion to the volume of gas consumed; but take a number of those same heaters, and you cannot develop an amount of heat proportionate to the number that you use. Can it be possible that there is a difference of intensity as distinguished from volume? Do I make myself plain? For instance, you cannot heat a steam boiler with gas. Why? Because, while you can easily boil a quart of water over a small gas burner, and convert that into steam, it seems almost impossible to develop heat enough to heat a steam boiler sufficiently to convert that larger quantity of water into steam. Is it not the same way with light?

Mr. Thomas—I think the difficulty in heating water with gas is because of the lack of proper appliances. In the natural gas district they do heat their boilers with gas, and they do it with comparatively a very small quantity. In that district I saw recently some large boilers, moving engines of 100-horse power, heated by the aid of but four gas jets. Each jet proceeded from a quarter-inch pipe. They used what might be called a crude Bunsen burner. Into a piece of pipe eight or ten inches long, a quarter-inch pipe was inserted at about one-fourth the length, and the flames coming out from the larger pipe circulated around the boiler. They were not the kind of boilers best adapted for making steam, being of the ordinary flue type. Speaking of cheap gas reminds me that this afternoon, on my way down to your assembly rooms, I met a gentleman who said that they expected very soon to introduce this fuel gas into Boston. This cheap gas, they claim, can be made at from two to six cents per thousand cubic feet. In using this gas as a fuel for heating boilers its employment was found to be cheaper than if coal had been used. On my visit to the natural gas district, I saw a boiler with a capacity of about 40 gallons heated by a single quarter-inch jet, adjusted as before mentioned, and steam was raised in 45 minutes. At Beaver Falls I saw them testing the natural gas in comparison with the manufactured product, and what seemed to me to be most singular was that the cheap, or said-to-be "two-cents-a-thousand" article, required a greater supply of air for its proper combustion than the natural gas did. As near as could be determined, it required 50 per cent. more. While in conversation with the gentleman above mentioned, he told me he had demonstrated the fact that it was not only a heating gas, but also an illuminating gas. Said he, "We have tested it here, and if you will come down we will satisfy you that it is far superior to any illuminating gas that is being sent out to-day."

The President—Is its price to be only two cents per thousand cubic feet?

Mr. Thomas—The cost of its manufacture, they claim, will run from two to six cents per thousand cubic feet. They claim they can manufacture all the way from two to six hundred thousand cubic feet of gas from a barrel of oil; so you see there is quite a margin to be expected in its cost.

Mr. Taber—I would not like to be reported as saying it is impossible to heat a boiler with gas, for I know better; but my point is, that taking a simple, ordinary burner, and placing it under a quart of water, you can boil that quart of water. Nevertheless, place it under three gallons of water, and, practically, the water will not boil. Perhaps the light is in the same ratio, and that from a small light you can get proportionately a greater degree of illumination.

Mr. Coggshall—I would like to ask Mr. Thomas if it, the natural gas, was thus used at Beaver Falls, or was it this newly manufactured gas?

Mr. Thomas—It was the natural gas. I will also state that one or two of the large users of natural gas have purchased the right to manufacture this cheap gas; and they said that they were going to substitute it for the other. Whether they have done so or not, I cannot say.

Mr. Coggshall—An apparatus was put up in a Philadelphia saw works, but the scheme proved to be a failure.

Mr. Thomas—They have never tried this gas there to my knowledge. A syndicate, which included mill operators, purchased the right for six States, including Pennsylvania, and they proposed to introduce it into their factories. As the natural gas is brought to Beaver Falls from a point eight or ten miles distant, they concluded it would be cheaper to manufacture the gas near at hand than to pay for the transported natural gas.

Mr. Coggshall—You have not seen any of this manufactured gas in use, have you?

Mr. Thomas—No; only in the experiments.

Mr. Greenough—If Mr. Thomas will guarantee the manufacture of 600,000 cubic feet of gas out of a barrel of oil, I would be glad to be put in communication with the owners of the process.

Mr. Thomas—I have no doubt of it, Mr. Greenough.

Mr. Nettleton—I move the thanks of the Association to Mr. Prichard and Mr. Taber for their very valuable papers. The motion was carried.

The President—In connection with that motion, I would suggest that the recommendation of Mr. Taber, with reference to the appointment of a committee to yet further investigate this important subject, be carried out. I advise that those two gentlemen be specially requested by the Association to continue their investigations and experiments during the coming year, so that a year from this time they may be able to favor us with still more light on the subject.

Mr. Thomas—I move that Mr. Prichard and Mr. Taber be appointed a committee for that purpose. (Mr. Greenough suggested that the committee, if appointed, be authorized to draw upon the Treasurer in the sum of $50, to cover expenses connected with the investigation. The suggestion was acquiesced in.)

The President—It has been moved and seconded that Messrs. Prichard and Taber be requested to continue their experiments during the ensuing year, and that they be authorized to draw upon the Treasurer for $50 in payment of necessary expenses. There being no objection made it is so ordered.

Mr. Jones—I notice that Mr. Taber has made some use of the jet photometer in his experiments, and as there is some discrepancy between the bar and the jet, I would like to present to the Association, or to that committee, two nicely-adjusted jet photometers for use in their investigations hereafter. [Applause.]

The President—I can say in behalf of the committee, and in behalf of the Association as well, that the generous offer of Mr. Jones is accepted, with thanks.

On motion, the Association adjourned, to reconvene Thursday, February 17th, at 10 A.M.

SECOND DAY—THURSDAY, FEB. 17—MORNING SESSION.

Pursuant to adjournment, the second day's sessions were commenced at 10 A.M., February 17th.

The President now introduced Mr. F. S. Richardson, of North Adams, Mass., who read the following paper on the subject of

THE INTRODUCTION OF HIGH CANDLE POWER BURNERS.

Presuming the retort house is economically run, and the quality of gas always kept at or above 18 candles, the next vital point, at least to the manager of small works, is to know his consumers. I believe this more firmly than ever since the introduction of the "High Candle Power Burner;" and the few practical points concerning our adoption, use and sale of the Lungren Lamp, convince me it is a mistake to lose sight of that fact.

At present a serious problem for many is to discover the best course to be pursued in fortifying the basis of their business; a perplexing question to determine what aggressive line to adopt in the effort to increase the sales of gas. I believe if one becomes convinced, after some research into details of the merits of any new appliance or system for illumination, he will not be successful in winning his customers if he does not hold to that, and that alone; for it will not do to *finesse* with the public in selling gas. So many dif-

ferent burners, lamps and attachments, are now offered to gas companies, by circulars and through solicitation, that a choice seems to buy all, or none; still you need something of the kind, and finding one that combines merit and durability, to a point where you can believe in it yourself, that part of the problem is solved. It was in this manner, and through these premises, I became a convert to or a disciple of the high candle power regenerative burner, so well known to you as the Siemens-Lungren Lamp, the first one of which, with us at North Adams, was purchased last Spring, and sold to light a carpet store (24 ft. x 12 ft.) in our city. This it did perfectly, with a consumption just short of 12 cubic feet per hour; although with a little suspicion as to that quantity on the part of the purchaser. Before the month had passed we hung two more, displacing 11 oil lamps, in a grocery store, but with the same feeling of uncertainty on the part of the purchaser about the expense. Since then the lamps have sold on their merits, helped—I'll confess—by no little amount of personal solicitation, until now we have 50 of them burning. They have been placed in every class of stores and offices—dry-goods and grocery stores; millinery shops and bar-rooms; hotel offices and drug stores; with cigar and barber shops included. Every condition, save house use, we have furnished, and without a single complaint. No one that has used the lamp has given it up.

I know our experience has not been as wide as that of others in this field—for there are companies whose consumers are using a greater number of these burners; but I have, save in three instances, *sold* the goods, the exceptions being now on rental. If a company has a large surplus, 20 per cent. can be earned upon the investment by renting the lamp for $1 per quarter; but there is a chance—a possibility—of the users turning to other modes of illumination, upon slighter provocation than would be the case if they owned the lamp. Yet the lamp is worth the money, for it is a fixture, burner and globe complete, and is an ornament to any room. I urge their *sale* because of their worth, and because their price can be saved, in the amount of gas bills, in less than a year. The parts are thoroughly made; the governor is perfect in its working, and seldom requires cleaning. Every part is duplicated, easily adjusted, and, save the asbestos flame-plate, practically indestructible. A few of our lamps have run six months without requiring any attention, whilst others need looking after occasionally. This we do not consider, as I sell the lamp, hang it, and agree to give it all necessary care for the cost at the factory. This slight concession has done more to sell the lamps than anything else, save, of course, the strength, economy, and beauty of its light. The one paramount virtue of burning gas in this regenerative burner is its cheapness; and when to that we add its cleanliness, its perfectly white and steady light, it commends itself to the most skeptical. I have urged its economy to everyone as to itself alone, except when asked to show comparison with the electric light. This ground, however, I have tried to tread delicately upon, although we have displaced three arc lights in three different places by two Lungrens in each instance. There is now a field that gas cannot fill, for everyone will not use the same light—in reality, the salvation of both systems. We all know that electricity is getting to be a paying commodity; that it has come to stay, and that for the matter of cheapening its cost to the user, the efficiency of the circuit maintained, and, in fact, the best general good to all parties concerned, it should be operated by the gas companies. We have every needed facility, and are possessed, I maintain, of the spirit of fairness and courtesy in a greater degree than is the case with the representatives of any other kind of business, in that we deal so closely with what is termed the public; but, above all, a gas company is in the lighting business. The two should be one, for the public good; and the Legislature of Massachusetts could do no better winter's work than by passing a general law sanctioning such combination, upon vote of the respective stockholders, and place both under the control of the present, and very able, Gas Commission. At this time there is absolutely no legislation regarding electric lighting. Gas companies are both protected and restricted, and I hold the same, in nature, should be given both. Asking your indulgence for this digression, I will return to my theme.

A very few facts, bearing upon general results, may, with judgment, be mentioned; but what is given is neither the result of experiments nor of close mathematical calculation. A universal adoption of these burners, in place of the ordinary lava tip, would largely reduce our sales; but the new meters set in displacement of kerosene oil—our strongest competitor—would make up this loss, and you are placed upon a firmer and broader basis for business, whilst the amiability between the gas company and its patrons is enhanced a hundred fold. It is worth a great deal—in fact it is worth many hard dollars—to satisfy those paying large gas bills, by increasing and improving their service at reduced cost.

The strength of the light from a Lungren lamp was never better tested, with us, than by the use in the company's own office of a 16-foot burner, in place of a 6-light chandelier fitted with 6-foot tips. By the substitution we obtained more than twice the light with less than one-half the former consumption. It would seem trite to mention many of the happy results obtained by the North Adams Company in this line; but for the benefit of even the one who has not tried the lamp I may be pardoned. The store mentioned as the second user burned the two 12-foot lamps at an expense of $2.48 per month, for the months of May, June, July and August; and since their adoption last April, up to February first of this year, with gas at $2.25 per thousand, they have cost $31.76. No single month shows in excess of $4.50, and with an average of $3.17 for the 10 months. The proprietor truthfully claims, taking into account every consideration, they cost him less than did the 11 oil lamps. A second experience is that of 19 oil lamps, hung in single file, in the length of the store, which were replaced by two Lungrens, with a result of an improved illumination, no extra expense, and entire satisfaction. One of our national banks shows beautifully the advantages of the lamp, whilst three in a corner drug store light the entire place for 15 per cent. less than was the case when lava-tip burners were used, the original illumination having been aided by kerosene. One, nestled in the corner of a very large hotel office, holds its own against its big brother, an arc light, in the centre of the room, and excites the curiosity of many and the admiration of all. Perhaps the best illustration of the difference in expense between the small burners and the use of the Lungren lamp, is shown by the bills of two drug stores—other than the one before mentioned—of exactly the same size, and doing business side by side. The former showed, for 8 months, bills amounting to $85.29, an average of $10.60 per month; the latter, $41.19, an average of $5.19—a total difference of $44.10 or $5.45 per month, in favor of the Lungren, besides the advantage of superior light. Here is splendidly demonstrated the saving of 50 per cent. by the use of this method of illuminating.

I find upon careful calculation, and almost 11 months' experience, that two 12-foot Lungren lamps light the same internal area equally as well as would be done by a full arc light, with the positive advantage of two points of distribution, a light that is white, perfectly steady, and under one's own control. They cannot pass and consume more gas than claimed, so the expense may be calculated to a nicety. A comparison, with a charge of, say, 40 cents per night for an arc light, and gas at or about $2 per thousand, shows that two Lungrens will burn one year for one-half the expense of the arc, and light the same space. The heat generated is urged against their use; yet, in this climate, eight months of the year their heat is a benefit, during two more it is not noticed, and the remaining ones (say July and August), every door and window is open, and the time for burning is so short, that, unless the ceilings happen to be very low, the heat is imperceptible. Excellent results have been obtained by their use out-of-doors, *i. e.*, under porches and awnings, during summer time.

The lamp is so very cleverly constructed that it is simple, and still every vital point is nicely covered. It seems, at present, to be the very perfection of gas burning, with but one objection—which certainly is an objection—the first cost of the lamp. Most assuredly I say nothing to reflect upon the business tact and ability of Brothers Stein and Brognard, for I feel sure they quote them as low as possible; but why the easy, graceful and ornamental little concern should cost $20 and upwards, net, is a mystery. This fact alone hinders a veritable landslide toward their adoption; and could increased facilities in their manufacture cheapen their production, 24 hours each day would be too short a time in which to fill the orders. They would sell on sight, as one mention will show. Besides a single order for 60, for use in a gingham mill, I have lost an equal number from the cost. Yet, even at the present price, they are the most inexpensive method of illumination for the purposes designed; and, if the worthy President of the Company shows but his past energy, I predict the faternity will soon receive notice of a "cut in rates" from Philadelphia, followed by our wishes for "many happy returns of the day".

[To be continued.]

An Improvement (but on Paper Only) in Apparatus for Making Gas.

By Frederic Egner.

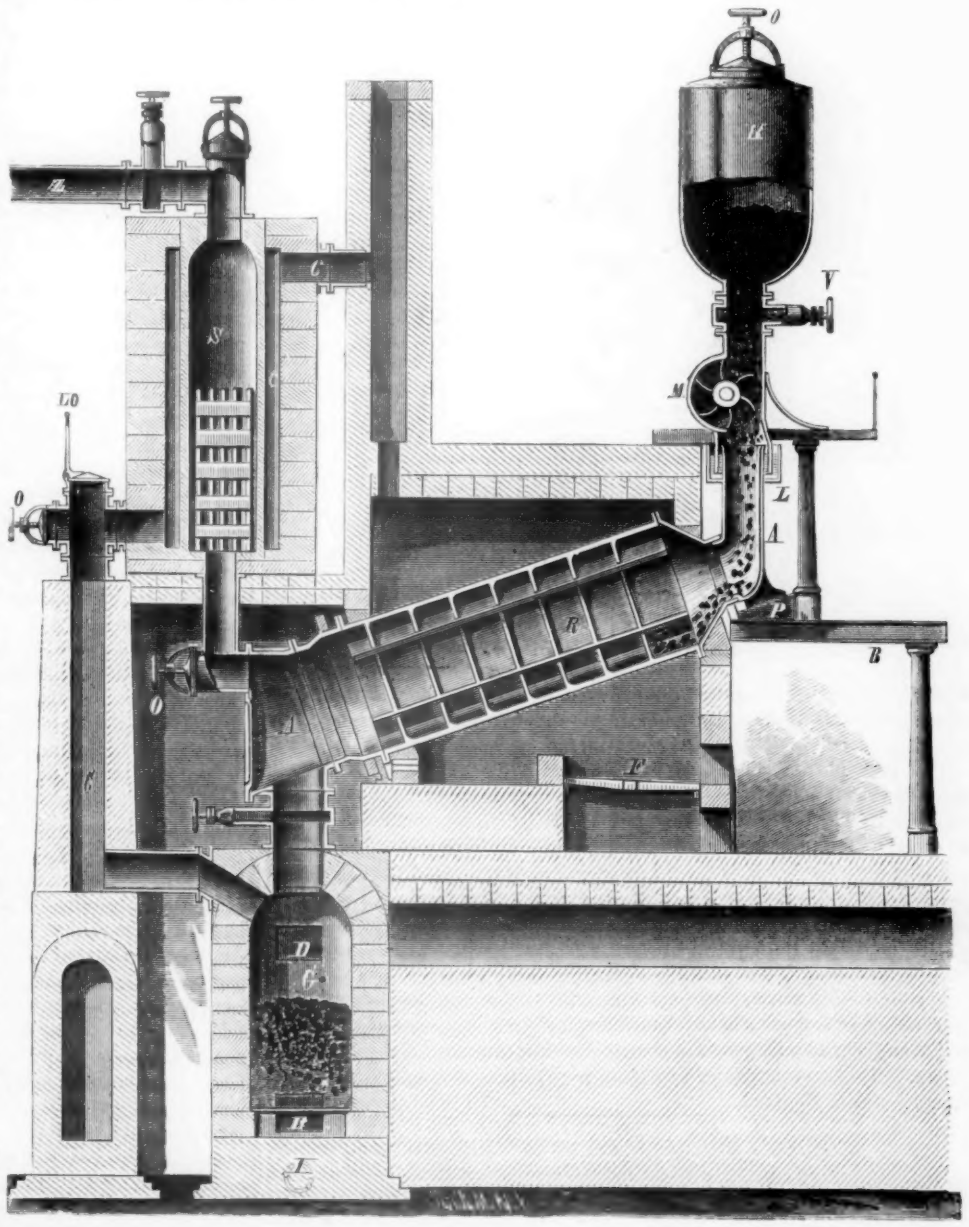
Some years ago, when the author acted as engineer-in-charge of the plant of a small Southern gas company, he was fortunate to serve under a gentleman who, as President of that company, was not only not a mere figurehead, but, on the contrary, being well versed in the practical details of the business, took pleasure in discussing the same frequently with the writer. It was after one of these pleasant exchanges of views, on matters connected with the manufacture of gas, that the apparatus herewith illustrated was conceived. It is true the machine was never built, but remained "an improvement in apparatus for the manufacture of illuminating gas" on paper only—like so many more pretentious inventions of to-day are, in fact, but to which our attention is called frequently by the positive assertions of their progenitors in respect of what the apparatus could accomplish were the same once put into practical operation.

It is sometimes interesting and instructive to read about the attempts—even if they were but failures after all—of others; and, thus viewing the case, a description of that all-but-forgotten invention of the writer's may, perhaps, be looked over with interest by the professional readers of this Journal.

The illustration represents a cross-sectional view of a side elevation of the apparatus, and the reference letters may be thus explained. *H* is a hopper or coal receiver, closed air-tight at the top by the removable door *O*. Several of these doors are placed in desirable positions on the apparatus. *VV* are valves, to use as occasion might require. It had been intended to employ water-cooled valves, somewhat similar to those invented since that time by Leadly. *R* is a cast iron retort, cylindrical in form, divided internally into a number of compartments by means of annular lips or flanges and longitudinal ribs or partition pieces. The retort rests, at both ends, on half-pillow blocks composed of small rollers—but not clearly shown in the cut. It is closed at the extremities, and still further supported and kept in place, by one stationary and one movable mouthpiece. The movable mouthpiece *A* at upper end rests on the inclined slide *P*, which, being in the same plane as the axis of the retort, allows for expansion or contraction of the same. Between the hopper *H* and the movable mouthpiece *A* the joint is effected by the tar, water, or sand lute *L*; *P* and *H* being supported independently by beam *B* and suitable pillars. *G* is a water gas generator, or the coke chamber, provided with doors *DD*, also a blast pipe and steam connections at *I*. *CC* are hot air chambers or flues for the passage of the combustion gases. *S* is the superheater or fixer for the gas. *Z* is a pipe for leading off the generated illuminating gases to the purifying apparatus.

The process of gas making in this apparatus was to be as follows: The hopper being filled with coal, the air-tight cover closed, and the retort brought to a dull-red heat—say about 980°, at which temperature it was to be maintained throughout the operation—the retort is caused to slowly revolve by means of a cog-wheel keyed upon its lower end, the latter being engaged by a pinion upon a shaft (not shown in the cut) which imparts motion to the whole. As the retort turns slowly over the fire on the grate *F* the coal drops from the upper chamber into the next one below, and so on until the coal, deprived of the richest and largest of its gaseous content, drops into the coke chamber. As the upper chamber of the retort is emptied, the measuring drum *M* delivers a fresh charge of coal from the hopper into the carbonizing vessel.

At the working temperature mentioned the result from a ton of coal carbonized would be about 6,000 cubic feet of a rich gas, a large quantity of tar and other vapors, and some very indifferent coke. In the ordinary process the tar vapors are, almost immediately upon their emergence from the retort, condensed in the hydraulic main; but in the process under description the tar—still in the shape of vapor, to which condition it cannot easily be restored, having been once condensed—is brought into the superheater *S* (or a retort heated externally and loosely filled with brick laid in the well-known checker form), where it is converted into a rich gas. In this way alone it was believed that the product of gas per ton of coal would exceed any results previously obtained under the old and well-known methods of gas making; but the resultant coke, while yet in a red-hot state, was to be treated to a current of superheated steam, with the object not only of considerably augmenting the volume of gas made, but the latter volume, being non-luminous, would furnish a proper diluent of the otherwise too rich gas obtained from the tarry vapors. The quenched coke might be removed; but were it not desired to save it the usual and well-known method of "blasting," subsequently adding a trifle of oil to the gas thus made, could be followed. Provision for that purpose was plainly made, as reference to the drawing will prove.



In practice it was found that iron retorts, when not subjected to a heat in excess of the one above described, had, after 15 months duty, preserved their integrity. Practically they were as good as new.

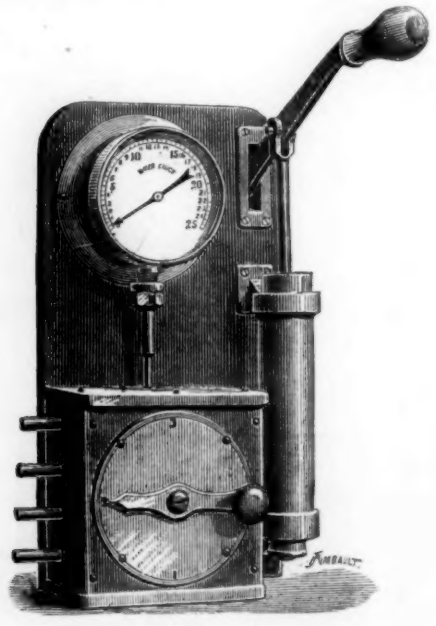
Several parties offered to furnish the means to build an apparatus, like the one described, on a large working scale; but, while the inventor would have risked his own money—if he had had any to risk—in a trial of the machine, he was not willing that others should, perhaps, sustain a loss. And so the project was laid aside—"maybe forever."

A portion of the machine would seem quite suitable for the purpose of making animal charcoal, or bone black, since certain objections to be met with in the manufacture of gas from coal are not met with when bones constitute the material to be used.

The indulgent reader may be disposed to admit that—on paper—the apparatus above described does not look altogether bad; but if the machine were built the verdict might not be so favorable. However, it may be safely said to be probably as good as most of these paper-patent processes—those which have never been tried save in the imaginations of their "discoverers."

Smale's Pneumatic Hydrometer.

Smale's pneumatic hydrometer, according to *Engineering*, is a handy instrument for measuring the depths of fluids. It is capable of being applied in many different situations. For instance, it may be used in a ship to ascertain the depth of water in the different compartments, and for this purpose it is placed in the chart room or in the engineer's cabin, and enables the officer to sound each part of the vessel in succession without leaving his post. In a brewery it will indicate to the manager the amount of water in the well, and in the various tuns throughout the building. In the latter case the dial may be marked in gallons if it be preferred. Many other situations will suggest themselves to the reader (the gas engineer will note at a glance how useful the instrument may be to him) in which an instrument



Pneumatic Hydrometer.

that will measure the depth of liquids at a distance, without involving the trouble of a visit to the spot, would be most convenient and economical of labor.

The principle on which the hydrometer acts is exceedingly simple. A pipe, open at the lower end, is placed in each tank or compartment to be measured. The other end of this pipe is led to an air compressing pump provided with a pressure gauge. The pump is worked and air forced into the pipe until the whole of the liquid is ejected from it, and the air escapes at the lower end. A reference to the gauge shows the pressure required to effect this, and this amount may be readily converted from pounds per square inch into the equivalent head of water. Or better still, the gauge may be marked in feet of the liquid which is to be measured.

The above illustration shows the instrument as constructed for sounding four vessels or compartments. The four pipes lead to a four-way cock, by which any one may be placed in connection with the pump and the pressure gauge. The manufacturers are Messrs. W. Reid & Co., 45 Fenchurch street, London, England.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Feb. 10, 1887.

Temperature and Consumption of Gas.—Curious Flames.—The Foulis Gas Fire.—The Hefner-Alteneck Photometrical Standard.—Gas Business During the Second Half of 1886.—*The London Gas Companies.*

A recent issue of the *Journal of Gas Lighting* contains two diagrams, prepared by Mr. Frank Livesey, Chief Engineer to the South Metropolitan Gas Company, illustrative of the effect of atmospheric temperature on the gas consumption in his district for the years 1884 and 1885 respectively. The variations in the rate of consumption, after allowing for influences such as the rate of permanent increase, the effect of holiday times, etc., show a marked sympathy with the variations of the thermometer. As the thermometer falls the consumption rises, and *vice versa;* and the conclusion arrived at is "that the temperature is the principal agent in the production of variations in the gas consumption, as compared with that at the corresponding period of previous years." There are no special features about the South Metropolitan district which prevent the diagrams from being a fair representation of the results obtaining generally in our large towns. As there is no reason to suppose that the atmospheric temperature has any direct effect upon the period of daylight, the principal conclusion to be drawn from Mr. Livesey's interesting diagrams is that gas is used to a considerable extent for warming purposes.

Mr. Thos. Fletcher, of Warrington, has lately been lecturing upon "Curious Flames," illustrating his remarks with experiments partaking of a popular science character. He first shows his reasons for believing that, contrary to general opinion, a large flame is really an evidence of waste. A boiler with the flues filled with flame does not give nearly such good practical results as when only a very small flame, barely visible over the bridge of the furnace, is obtaining. The gist of his interesting experiments is that a large flame means either an insufficient or an improperly arranged air supply; the result of which, in the case of a boiler is that large quantities of heat are wasted by dilution with an excess of air, which passes uselessly up the chimney, taking large quantities of heat away with it, and, therefore, leaving a less quantity for practical utilization. Or in the case of a vessel being heated over a gas burner, large volumes of air are heated by the large flame, and considerable quantities of heat are thus wastefully diverted from the object which it is sought to effect. If suitable arrangements are made for mixing the combustible gas with something like the proper equivalent of air, which is shown by theory to be necessary for combustion, a much smaller, but very much more intense, flame is the result; and under these conditions much better results are obtained in practice than in the former case. With a combustion of two cubic feet of gas per minute Mr. Fletcher produces a great flame, 8 inches in diameter by 18 inches high, and he proves, by experiment, that it is a mere shell or envelope, the interior of which is perfectly cold, and that it is almost useless for practical purposes. He then shows that by a rearrangement of the air supply, which in effect consists of mixing the gas before combustion with its proper equivalent of air, the flame is rendered "solid," whereby it is much reduced in bulk, but is much more manageable, and yields a much greater practical duty. And, finally, he proves that by careful adjustment of the air supply, and by placing a suitable solid body, heated to a sufficient temperature, in the path of the mixture, perfect combustion can be secured without any visible flame at all; and that these conditions secure the greatest possible amount of heat from the combustion of a given quantity of gas. His experiments are extremely interesting to all concerned in the practical application of heat for any purpose.

Mr. Wm. Foulis, Engineer to the Glasgow Corporation, and President of the Gas Institute, has lately introduced a new gas fire, applicable either to asbestos lumps or fiber. Instead of placing the burner immediately below the material that is to be rendered incandescent, so that the flame plays upon, and the act of combustion goes in actual contact with the same, he fixes it several inches below, and a curved channel, formed by blocks of fireclay, leads up to the material. By this means the flame is not only protected from draught, but combustion takes place without any cooling influences, thus securing the development of the highest possible initial temperature. The burner arrangement comprises a number of finger Bunsen burners, each fitted with a separate tap, so that any number between one and the whole may be in use according to the quantity of heat desired. The products of combustion descend at the back of the slab and pass off to the flue or chimney near the floor line; and there is an arrangement by which air, brought in from outside if preferred, is made to pass through the body of the stove, taking up heat as it travels, and escapes in a warm condition at the top.

Several members of the German Association of Gas and Water Engineers have been making practical tests with the Hefner-Alteneck amyl-acetate lamp as a substitute for the time-honored "candle" in photometrical experiments, and the results are in the main favorable to the appliance. This lamp certainly possesses the advantage of simplicity, as it merely consists of a reservoir for containing the fluid, a German silver tube of a given thickness and diameter to contain the wick, and two horizontal wires or pointers attached to a light frame for adjusting the height of the flame. No special care is necessary as to the wick, the principle of the apparatus consisting in the assumption that when the flame is adjusted at the proper height the light is constant. It is claimed that a flame about 40 mm. in height will give a light equal to the English standard sperm candle. This arrangement is so portable, simple and cheap that it is to be hoped that the successful results already recorded will be substantiated by further experience. It appears, however, that some skill is necessary in the manipulation of the lamp; for while some observers have experienced uniform success with it, others make various complaints. They say that the flame is very easily affected by draughts, that it is liable to yield a disagreeable odor, and in one case the fluid seems to have been impure. Of course, the main point is the possibility of relying upon the amyl-acetate as being always of constant quality and homogeneous in composition, so as not to vary after several hours' use in the lamp. It is claimed that the method by which it is produced is such as to enable this to be guaranteed. At the last meeting of the Association the experimenters compared notes, and their results are sufficiently encouraging to

warrant the expectation that the Hefner-Alteneck lamp will prove a useful appliance for gas engineers, even if it is not raised to the dignity of a standard. It requires no elaborate preparation, being ready for use in a minute or two at any time, and it is said that when the flame is once properly established, an unvarying light may be maintained for many hours. One advantage of the lamp is that it can readily be attached to one end of a scale beam, as is usual with the candles, and the rate of consumption accurately ascertained.

With the opening of February comes the usual half-yearly budget of reports from various gas undertakings, as to the working during the six months ended Dec. 31, 1886. The weather during that period was milder than usual, and this has had some influence on the gas consumption, an effect that would have been much more marked but for the spurt of genuine winter weather that set in just before Christmas. As it is, however, the general experience is that the usual rate of increase in the consumption of gas has not been maintained. The low state of the residuals market was another adverse circumstance, intensified by the fact that the long run of mild weather diminished the demand for coke. On the other side, coals and iron have been cheap, so that in most cases a fairly satisfactory balance sheet has been realized, and the usual dividends can be paid without increasing the price of gas. But some companies have to dip pretty deeply into the accumulated funds in order to maintain this state of things. The Corporation of Birmingham and a few other undertakings have been obliged to resort to an increase of price, a step which, it is needless to say, is almost equivalent to disturbing a hornet's nest. Hopeful opinions are generally expressed as to the future. There are signs that the depression in trade, which has now existed for some time, is moving, and it is to be hoped that it will give way to a prosperous state of affairs, in which gas undertakings would participate in common with other industries.

The report made by the directors of the Gas Light and Coke Company of London sets forth that there is a balance available for dividend of £383,927; but this includes an amount of £119,462 carried on from the last account, so the actual earnings during the six months in question are £264,465. It is proposed to pay a dividend on the ordinary stock after the rate of 12 per cent. per annum, which will absorb £328,076, or £63,611 more than has been earned. The effect of this step will be to reduce the balance of undivided profit to £55,851, or more than half. Owing to the causes above named the receipts for gas remain about the same as in the corresponding period of last year, but the residuals have fallen from £282,493 to £244,840, a drop of £37,653. It will be observed that the loss on the head of residuals is not sufficient to account for the reduction in profits, which is actually nearly £80,000 less than during the corresponding period of 1885. The report of Mr. Harris, the distribution engineer, certifies that the gas mains belonging to the Company are about 1,800 miles in length, that the number of meters in use by the consumers is about 201,000, and that 5,688 gas stoves are out on hire. The directors speak hopefully of the increased day consumption. Unless things improve with them a rise in the price of gas appears imminent.

The South Metropolitan Gas Company has been more fortunate. They only require to draw upon their balance of undivided profit to the unimportant extent of £2,686, in order to pay their usual dividend of 13 per cent. A small increase in the consumption of gas, 4½ per cent., has been experienced, and it should be observed that while this is small as compared with the usual rate of increase experienced by this Company, it would be considered extremely satisfactory by many boards of directors. They have, like their neighbors on the other side of the Thames, experienced a loss on residuals; 27 per cent. of the total production of tar has been used as fuel, and as such is worth 1½ d. per gallon, whereas it realizes only ½ d. at present selling prices. But for the reduced value of residuals there would have been a surplus on the half year's working, notwithstanding the reduction in the price of gas which was made at the beginning of the year.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

They Voted for Electricity.—At a public meeting of the electors of the town of Hillsdale, Ohio, recently held in the local Court House, the voters balloted upon the question as to whether gas or electricity should be used for public lighting during the coming year. A count of the votes showed that 288 favored electricity, while 35 adhered to gas. The matter of a choice of electric systems was left to the decision of the Town Council.

Gas Works for Dodge City, Kansas.—Several prominent men of Dodge City have subscribed $50,000 for the erection of a gas plant in that locality. Work on the same is to be commenced forthwith. Dodge City is the capital seat of Ford county; is on the Arkansas river, and the main line of the Atchison, Topeka and Santa Fe Railroad, at a point 302 miles west-south-west of Topeka. Population about 5,000.

President Morton on Measurement of Arc Lights.—President Henry Morton, of the Stevens Institute of Technology, Hoboken, N. J.—and probably a more expert and painstaking scientist does not live to-day—recently visited Bridgeport, Conn., at the invitation of a committee of the Aldermanic Board of that city, for the purpose of testing the actual candle power of the arc lights there maintained at public expense. In his official report to the Board the experimenter said: "The average candle power of the 15 lights, when measured, was about 1,100 candles, or in exact figures, 1,111 candles. As compared with the electric lights used for lighting the streets of our cities generally this is a very good showing. I had occasion some time since to measure the light of a number of the lamps used in the streets of New York city, and found that the best of them only reached 800 candles. It has been customary ever since the first introduction of electric lighting for the electric companies to call their ordinary street lights '2,000-candle power lights,' though they have not possessed any such actual efficiency. If, therefore, you were to hold your electric light company to the wording of their contract, they might reasonably claim that the term '2,000-candle power' had become a technical expression, meaning only a light of the usual efficiency from 500 to 1,000 actual candle power by direct measurement." No wonder the experimenter had reason for congratulating the Bridgeport City Fathers on the efficacy of their arc illumination; but we think a different order of affairs would be disclosed were the President invited to test the half-arcs supplied in Brooklyn. In connection with this matter of the actual candle power of arc lights we think it timely to reproduce the figures furnished by the Committee of the Franklin Institute in regard to their examination of the arc lights displayed at the Institute's Electrical Exhibition, held in the fall of 1884. The Committee thus reported:

Name of Lamp.	Candle Power. Horizontal.	Candle Power. Angle, 45°.	Horse Power, per lamp.
Arago	273	583	.824
Ball	223	485	.432
Brush (1,200)	180	613	.466
Brush (2,000)	389	1,373	.785
Diehl	323	830	.754
Richter	313	894	.812
Van de Poele	333	1,162	.817
Western	263	266	.617

The lamps of the Thomson-Houston and United States Companies were not exhibited. Ten observations of each lamp were made (the above represents an average) at each of the several altitudes measured, and the variation in the intensity of each lamp during the test, at any altitude, was found to be very great. A more extended mention of this subject will be found in the issue of Journal for July 2d, 1885, Vol. 43, p. 2.

Capital Stock Increased.—In our last we announced the formation of a Company to build gas works at Castleton, Staten Island. The capital stock was originally fixed at $50,000, but that amount has since been doubled.

Preparing for the Near Future.—The proprietors of the St. Paul (Minn.) Gas Light Company have purchased 4½ acres of land, in the tract known as "Hewitt's Addition," at a cost of $10,000, with a view to securing an eligible basis for locating a future works. The purchase was a wise one, for at the figure named, even if a gas plant will never be put on it, the site cannot fail of being a profitable investment in a speculative point of view. We understand that the St. Paul Company will shortly make provision for the supply of the suburban districts bounded by Hamline, Merriam Park, and Macalester.

Huron wants a Gas Works.—A petition was presented to the City Council of Huron (Dakota Territory), on Feb. 7th, by parties who asked a perpetual charter for a gas company for that place. The petitioners sought the Council to agree to maintain 50 public lights, and to pay therefor at the rate of $35 each per annum. The matter was to have been settled either one way or another on Feb. 21st, but we have not been apprised of the result.

Sorely Bereaved.—We deeply regret to be called upon to announce the death of Elizabeth Lord Chase, late the wife of Mr. John M. Hill, so well known to the Eastern fraternity in his capacity of Agent and Treasurer of the Concord (N. H.) Gas Light Company. The sad event occurred on Feb. 5, and the funeral services were celebrated on the following Monday. Deceased was born in Boston, Mass., on July 3, 1825, and became the wife of Mr. Hill on Nov. 15, 1843. A bright woman, loving wife, and noble mother, deceased bequeathes to her bereaved ones an example of perseverance to the end.

The Test was Illegally Made.—Some time since an official inspection of the gas supplied in West Washington (D. C.) was made at an hour different from that prescribed by the law, and the result of the examination disclosed the fact that the gas was deficient in illuminating power. Thereupon

the authorities attempted to collect the fine imposed for such delinquency by the statute, but the Company demurred by asserting that the test was illegal, since the law directed the inspector to make his tests between the hours of 5 and 11 P.M. On the trial of the case it was proved that the inspection was made at 10 A.M., and Justice Cox thereupon dismissed the proceedings.

To Last for Twenty Years.—The agreement betwixt the United Gas Improvement Company and the old Yonkers (N. Y.) Gas Light Company is to last for 20 years from 1st of Jan., 1887.

Gas Legislation in California.—A bill for the regulation of gas companies in the Golden State was recently introduced in the California Assembly by Representative Lewis. It provides that no company shall collect any moneys for gas supplied unless the meter through which it was measured shall have been proved by the State Inspector of Gas Meters. Whenever any company, incorporated under the laws of the State, combines with any other company to raise or fix the price of gas, or leases its works or property to another gas company, whether to the trustees or otherwise, it shall lose all rights gained by incorporation, and its property of every kind shall escheat to the State. The company so leasing the works or plant of any other gas company for the purpose of controlling the price or the quality of gas manufactured shall suffer in like manner. All meetings of directors and stockholders of any gas corporation incorporated in the State (also all books, etc.) shall be open to the inspection of the Attorney-General, or of his deputy appointed for that purpose. Somewhat in the nature of a steel-clad proposition!

Killed by the Current.—Early last month a youth named John Brandt attended a performance at the Peoples Theater, Cleveland, Ohio. The lad, who was in the gallery, coveted a seat reserved for ladies, and in attempting to secure it attracted the attention of one of the ushers. Brandt, hoping to allay the latter's suspicions, crouched close to the wall, uttered a groan, and dropped to the floor. The unfortunate youth had come in contact with the wires leading to an arc light in the dome of the theater, and these having been improperly insulated, was killed. Coroner West and a jury certify to the cause of Brandt's murder—for it was nothing else.

A Big Electric Lighting Company.—The California Electric, Gas Light, and Fuel Company was incorporated in San Francisco on Feb. 11. W. D. Cluff, J. D. Boyer, and J. Dewing, of Alameda, H. McGovern, of Chicago, Ill., and B. B. Duncan, of San Francisco, are named as the incorporators. The Company is capitalized in $3,000,000, and it is said that it will supply electric light in Oakland, Sacramento, Los Angeles, San Jose, Stockton, and San Francisco. Perhaps the "Gas Light and Fuel" portion of the title is intended as a saving clause in case electricity will not be eagerly seized upon by the residents of the localities named in the prospectus. At any rate, the stock of the original San Francisco Electric Company can be bought quite cheap at the present time.

Another Golden State Company.—The California Gas Fixture Company has been incorporated. Object, to manufacture and sell gas fixtures, lamps, and oils. Capital, $100,000. Directors, J. Simonson, F. W. Farrar, R. P. Merrillion, G. F. Duffey, and E. J. Duffey.

Settling the Lighting Question at Xenia, Ohio.—The Xenia City Council has accepted the proposition made by the local gas company. Under the new arrangement the gas company agrees to supply gas to the city and to the citizens at the uniform rate of $2 per thousand cubic feet provided payments are made on or before the tenth day after presentation of bills. All new street gas lamps erected are to be supplied with gas at the rate of $26 per post per annum.

Annual Meeting at Nantucket, Mass.—The annual meeting of the Nantucket Gas Light Company resulted in the choice of the following Board of Directors: Messrs. D. C. Baxter, E. H. Allen, W. F. Codd, A. T. Mowry, and C. Parker. At the meeting for organization Mr. A. T. Mowry was elected President, and Mr. A. M. Myrick Secretary and Treasurer. The financial showing made by the Company in the past year was quite satisfactory to the shareholders. The Company was organized in 1854; is capitalized in $36,000; average price received for gas, $2.82 per thousand; works are calculated for a maximum per diem production of 28,000 cubic feet; total main mileage, 4¼ miles; total number of consumers' meters in use, 197; public lamps maintained, 71; average candle power of gas supplied to consumers in past year, 18.30; dividend payments, 6 per cent.

Will They Succeed?—We understand that State Senator McWhorter, of Delaware, recently introduced a bill in the Delaware Legislature which seeks to incorporate the Delaware Light, Fuel and Power Company. The parties named comprise Messrs. W. L. Elkins, Jr., of Phila., Pa., and Messrs. J. M. Dunn, J. P. Postles, G. W. Bright, E. Moore, Jr., and Jno. Peoples, of Wilmington, Del. The capital stock is placed at $100,000; but power is sought to subsequently increase the amount to $1,000,000, They propose to furnish "heat, light and power from gas, steam, electricity and other substances"—scientists will be glad to know that the applicants have thus settled the doubt in regard to what electricity really is; for "substances" are all so easily grasped. In order that the "substances" may be made available the petitioners ask for "full power and authority to enter upon streets, roads, bridges, tenements, etc., all over the State." This sweeping demand reminds us of the answer returned by the Delaware Legislature to a somewhat similar request made upon it by agents of the Standard Oil Company in 1881. The reply in effect was, "You may want the earth; but you can't get Delaware." If history repeats itself a like rejoinder would seem to be now in order.

And Yet Another.—Representative Ware has introduced a bill whose sponsors seek the right to charter the Citizens Gas and Fuel Company to operate in Wilmington, Delaware. The interested ones are Messrs. A. D. Warner, J. Bailey, P. Lea, T. B. Smith, W. G. Pennypacker, G. G. Lobdell, C. N. Trump, A. G. Wilson, J. H. Hoffecker, S. N. Trump, and L. Smith. These gentlemen are more modest than the others, for they simply wish to probe Brother Curley's territory. It is unlikely, however, that either set of speculators will obtain the desired grant.

An Interim Dividend of Four Per Cent.—The Quebec (Can.) Gas Light Company has declared a dividend of 4 per cent., payable from and after first instant, out of the earnings of the past six months, ended Feb. 1st.

Flatbush (L. I.) Street Lighting Contract.—At a recent meeting of the Flatbush town authorities a contract to run for one year from Feb. 14th last for maintaining 330 public gas lamps was entered into by the Flatbush Gas Company and the borough. The price agreed upon was $31 per post per annum, a decrease of $2 from the rate charged in 1886.

The Worcester Hearing.—The newspaper warfare against the Worcester, Mass., Gas Light Company having been transferred to the province of the Massachusetts Gas Commission, and with the usual amount of "indignant consumer" testimony being poured into the ears of the Commission, we must say that the latter are deserving of sincere commiseration. However, it does not seem that the Worcester *Telegram* agitators have scored much of a victory as yet, if we except the fact that the Worcester Company's main system seems hardly adequate to the proper supply of the district. As previously noted in the Journal, the Company, in any event, intended to remedy that defect with the coming season. In fact its plans in that direction were prepared some time ago.

Gas Engines in Fashion at St. Paul, Minn.—Quite a number (at least 30) of gas engines are in use in St. Paul, and when the $1.50 gas rate (it goes into effect on 1st prox.) becomes operative the employment of these motors will be greatly extended. We give a few examples of the actual expense that attended the operation of gas motors in St. Paul during the last year, when, it should be borne in mind, $2 per thousand was charged:

Operators.	Horse Power.	Business.	Cost for Gas.	Repairs, oil, etc.
R. L. Hardenhigh.....	7	Running elevator.	$171.20	$25
Volks Zeitung Co.....	10	Publishers.....	392.80	32
H. Schnell & Co.....	2	Grinders.....	103.20	None.
I. L. Herotz.....	4	Cigar boxes.....	151.60	"

The American Electric Manufacturing Company.—Gas men throughout the country must often wonder how it is that the American Electric Manufacturing Company manages to secure such a large number of "reading notices" in the various newspapers. Whoever has charge of that particular branch of Mr. Edwards H. Goff's business is an adept, and we surmise that Mr. Shanks, formerly of the New York *Daily Tribune*, could let us into the secret. The latter gentleman compiles what is now known as a "syndicate letter," which purports to give to those newspapers forming the "syndicate" the current gossip of the metropolis. Say, for instance, 20 newspapers, in as many different cities and towns, club together and agree to contribute $5 apiece each week in return for which they receive a letter from Mr. Shanks, who purports to place before them, in readable, gossipy style, the current week's news of New York city. Of course, the arrangement is a fair one, and results, no doubt, in benefit to Mr. Shanks and to the syndicate; but somehow or another the syndicate letters rarely fail to contain some direct reference to the American Electric Manufacturing Company, and to the "life's work" of Edwards H. Goff, its President. Our Eastern and Middle States' readers must also have noticed that Edwards H. Goff receives a good deal of notice in the pages of the New York *Daily Tribune*, and it may be considered certain that the *Tribune* folks are in the habit of exacting and receiving pay for the performance of advertising work, no matter whether the same be rendered in the shape of "reading notices" or not. Even at the

risk of devoting too much space (which cannot be purchased by anybody) to the American Electric, etc., advertising bureau, we feel that we ought to reproduce the following despatch, dated Boston, Feb. 17th, as it appeared in the columns of the New York *Daily Star:* "It is not generally known that the managers of the New England gas companies have been quietly holding a convention here for the purpose of considering the proposition of the American Electric Manufacturing Company of combining the gas and electric light interests. The result is that every New England manager who appeared in the conventi n indorsed the system of the American Electric Manufacturing Company, of New York, of which Edwards H. Goff is president, and will hereafter work in connection with that system of electric lighting." Now, this will be news to those who attended the 17th annual meeting of the New England Association of Gas Engineers, with the sole and simple object of comparing notes as to the progress gained by them in the gas making business during the last year. All things considered, it might be well for the American Electric, etc., if its advertising bureau were "reformed" to a slight extent.

To Push the Exhauster Branch of their Business—The Messrs. Connelly have determined to bring their steam-jet exhauster specialty prominently to the attention of the fraternity. Their card on the subject will be found in the advertising pages of our present issue.

Annual Election, Augusta, Ga.—At the stockholders' meeting (Augusta Gas Light Company) the following officers were elected: President, G. T. Barnes; Secretary, H. B. Adam; Supt., G. S. Hookey; Directors: Messrs. G. T. Barnes, E. R. Schneider, T. G. Barrett, P. Walsh and P. H. Langdon. The annual reports afford a most satisfactory showing.

Annual Election, Consumers Gas Company, Chicago, Ills.—This corporation has chosen the following officers: Directors, Messrs. C. E. Judson, W. H. Ryder, C. R. Cummings, S. A. Kent, W. S. Reyburn, J. E. Addickes, E. Washburn, C. T. Yerkes, and J. B. Cohrs. President, C. E. Judson; Vice-President, W. H. Reyburn; Sec. and Treas., F. P. Addickes.

Bids for Public Lighting, Scranton, Pa.—The Scranton and Hyde Park Gas and Water Companies offer to light the public lamps at the rate of $1.50 per post per month. One electric company offered to light with 2,000-candle power arcs on the basis of 30 cents per light per night, while another company would not undertake the task for less than 40 cents. The Sun Vapor Light Company (gasoline) wanted $19.50 per post per annum, while the Pennsylvania Globe (naphtha) Company would be content with $18.50.

To Provide Greater Security.—It is understood that Secretary Balch, of the New York State Board of Health, has drafted a bill, for the consideration of the present legislative conclave, which is intended to provide greater security to gas consumers. It was suggested by the late fatal Troy experience. It makes stringent regulations in the matter of piping, and requires that all gas intended for public use shall possess an odor sufficiently pungent to make its presence manifest.

The Malden Company's Record.—During the year ended December 31, the Malden and Melrose (Mass.) Gas Light Company manufactured 25,716,700 cubic feet of gas, of which 19,085,700 cubic feet were sold by meter, and 2,964,900 cubic feet were consumed in the public lamps, leaving the unaccounted-for portion at something like 3¼ millions. The works have a capacity of 200,000 cubic feet per day. During the year 2,218 tons of coal were carbonized, and 6,840 gallons of naphtha were absorbed.

The Frackelton Portable Gas Kiln.—Those managers of gas works, especially in the larger cities, who have not seen this kiln ought to make inquiry regarding it. The craze for "decorative art work," in the shape of amateur attempts at painting china ware, rages rather fiercely within the frame of the girl of the period, and gas men ought to take advantage of the whim. It will help their day consumption, for the aforesaid girl, once she knows where to secure the Frackelton article, or one equally as good as it, will not be satisfied with any other apparatus for "fixing" the creations of her art. Mr. Frackelton's address is 119 Wisconsin street, Milwaukee, Wis., and we cheerfully give him this notice, although the gentleman never thought it worth while to ask for it.

It Might have been Worse.—Some excitement was caused in Hollidaysburg Pa., on the afternoon on February 15, when it was thought the local gas works were about to be consumed by fire. They still stand, and the damage was not in excess of $50.

Fix up the Pipes.—Judging from recent reports the gas piping in the Capitol Building at Albany, N. Y., must be sadly out of order, for we are told that several departments were closed in the structure, on date of February 18, because of the prevalent odor of gas in the State's several-million-dollar building! Perhaps the cause was slightly exaggerated by those interested in the electric lighting business; for these promoters now light a portion of the premises, and possibly would like to secure the balance.

Tyrone, Pa., to be Lighted by Electricity.—The Tyrone Council has decreed that Tyrone's streets are to be electrically illuminated at night. The Home Electric Light Company's proposition, to furnish 80 twenty-five candle-power incandescent lights, to burn all night and every night in the year, at the rate of $16.66 each per annum, has been accepted; but the Home promoters also agree to furnish 18 sixteen-candle power lamps (to be divided between the city fire engine house and the Council meeting room) to the municipality free of charge. It would seem that another contract of the kind would be apt to hurry the Home's property to the care of the Sheriff.

Brother Alexander's Invention.—Most gas makers in this country are no doubt duly impressed of the fact that Miss Margaret Mather is an accomplished actress; but we incline to the belief that the fraternity will not concede her brother's transcendent abilities as a gas engineer. The family cognomen is Finlayson, and Miss Mather, of course, assumes her proper appellation when not engaged in displaying her talents on the stage; but, at any rate, in order to show why we are doubtful about her brother Alexander's claim to gaseous distinction, we submit the following concerning an "invention" recently brought to light, at Detroit, Mich, by the aforesaid gentleman. Over an ordinary stove, after the fashion of placing a pot, he sets an upright retort of "convenient size," said retort, having been charged with wood, is securely sealed prior to its location over the "kitchen fire." As the gas is distilled it passes "over the back of the stove" to a washer handily situated, thence to a purifier box, "fitted with three trays of lime"—it should be explained that the purifier is superimposed on the "washer," the latter being connected with the former by a "small hole"—then through another hole into a holder, from whence it passes into the house pipes, on to the jets, and "there is light." Perhaps, if Sister Margaret seeks to have some realistic stage effects—such as thunder, sulphurous smell, and debris—she had better introduce Brother Alexander's invention to the notice of her stage manager.

New Holder for the Springfield Gas Light Company.—During the present season The Springfield (Mass.) Company will construct a large holder. Negotiations for the purchase of the ground whereon to locate it are now in progress.

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

Mr. Egner in Further Explanation of that "Chapter."

St. Louis, Mo., Feb. 21, 1887.

To the Editor American Gas Light Journal:

With your permission permit me to say to "A. S.," whose latest comment appears on page 109 of current volume, that the station meter, photometer, and even the operator who recorded the meter statements and made the photometrical observations, which results were reported in the tables whose veracity is questioned by "A. S.," are the identical ones bequeathed to the Laclede works by Mr. Farmer. In most instances the very workmen about the plant can be traced to Mr. Farmer, although now "A. S." quotes Mr. Farmer's rule as authority for proving that I have erred. In fact the greatest difference perceivable in these works now as compared with the period of Mr. Farmer's rule is that the system of carbonizing has changed. For instance, in the last year in which the gentleman whose "rule" is quoted (probably to confound the writer) had charge of the works of the Laclede Company the average make per mouthpiece per diem equaled 6,201 cubic feet—average for the entire year is referred to—of 16.15-candle power gas; whilst in the year after the writer took charge of the plant the average daily make per mouthpiece was 9,066 cubic feet of 19.74-candle gas. This latter result, let me repeat, was secured by the use of same meter and photometer, by the same observer, the retorts being worked by almost the same men—the benches being similar except in the matter of slight alterations made by the writer—as those used and employed by that deservedly eminent gas engineer whose "rule" "A. S." quotes against my statements. My working system differed from Mr. Farmer's, and the foregoing is merely mentioned by the writer to show that the "world has not stood still" since "A. S." learned the principles of Farmer's theorem. The writer is not an "old gas man," but perhaps even "A. S." does not know it all. Evidently (to me at least) the latter could learn something by coming here. If he can pay me a visit it might serve him well to thus study up how my results were obtained. It would give me pleasure to show him on the premises how I secured them.

Yours truly, Frederic Egner.

The Market for Gas Securities.

Nothing of importance can be mentioned in connection with either the local or Brooklyn gas share market. Values have been fairly well maintained, but real transactions were few and far between. The sensation in out-of-town circles is furnished in the circular sent out by the managers of the old Chicago Gas Light Company, and reference thereto will be found in our editorial pages. They ought not to experience much trouble in securing purchasers willing to pay a higher price than that which it is urged should be accepted as an equivalent for the value of the property. The works advertised for sale in present issue ought also to be quickly snapped up, for it is a good property. We understand that a one-third interest in the Rock (Ills.) Gas Company can be purchased. Baltimore stocks are stronger, and possibly the Baltimore gas war will soon be ended. It is about time that Baltimore gas shareholders were allowed to enjoy their terrapin in peace.

SUPERINTENDENT'S POSITION DESIRED.

By a practical gasfitter and competent bookkeeper, who has had entire management of coal and water gas plants. Satisfactory references furnished. Address

665-3 "B.," care this Office.

ENGAGEMENT DESIRED

As Superintendent or Foreman of Coal or Water Gas Works.

Has had years of experience in manufacture or distribution of gas and construction of works. Address

665-1 "E.," care this Journal.

SUPERINTENDENT'S POSITION WANTED

By a practical manager of coal and oil gas works, of 22 years graduation in all the departments—viz., distribution, manufacture, and secretary's duties. Also has a partial knowledge of electric lighting. Satisfactory references given. Address

665-tf R. HORTON, care this Office.

Superintendent's Position Desired

By a practical man of twenty-five years' experience in the manufacture and distribution of coal and water gas. Satisfactory references given. Address

646-tf "ENGINEER," care this Office.

SITUATION WANTED

By a Practical Gas Engineer.

For 18 years in charge of very successful operations of a coal gas works. Best of references given. Address

"F. B.," care this Journal.

GAS WORKS FOR SALE.

A RARE CHANCE.

The owner will dispose of the controlling interest in a gas works in a growing Western city, on account of declining health and inability to attend to the business. For particulars address

665-6 P. O. Box 825, Appleton, Wis.

FOR SALE,

Two Sinuous Friction Condensers,

Each 1 ft. 3 in. wide by 11 ft. 3 in. long, and 18 ft. high, of sufficient capacity for 225,000 cu. ft. per day. Apply to

665-12 PETER COFFEY, Supt Gas Co., Peoria, Ill.

FOR SALE,

Ten No. 2 Siemens Regenerative Gas Lamps,

With Factory Fixtures and Reflectors complete and in order. Only used three or four months. Will be sold cheap.

DANVILLE NAIL AND MFG. CO.,
Danville, Pa.

ENGLISH

"Journal of Gas Lighting."

Issued weekly. New volume commences Jan. 1, 1887. Price, $7 per annum. Subscriptions taken by

CHARLES NETTLETON, Agent for U. S.,

No. 115 Broadway, N. Y. City.

Ferric Oxide for Gas Purification.

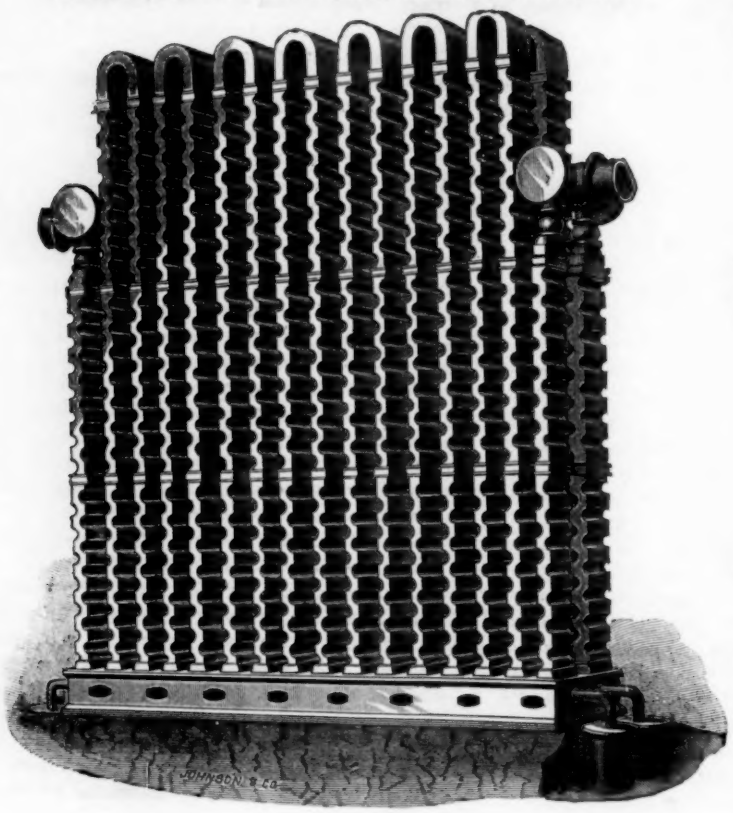
Ferric Oxide, as ground, screened, and prepared by me for purifying purposes, has now been in use for several years by many of the gas works throughout the country, including Detroit, Chicago, Milwaukee, East Saginaw, Burlington (Iowa), Ann Arbor, etc. It has proved, as I believe, the **Most Effective and Economical Agent** now in use. I am prepared to furnish the Oxide by the 100 lbs. or in car load lots, and will be pleased to give price f.o.b. cars at Ann Arbor or at place of destination. Address

S. H. DOUGLAS, Prest. Ann Arbor (Mich.) Gas Light Co.

F. J. DAVIS & J. R. FARNUM,

TRUSTEES AND AGENTS FOR THE

SINUOUS FRICTION CONDENSER.



We desire to draw the attention of the gas community to the merits of the Sinuous Friction Condenser. Companies intending to introduce new condensers into their works will do well to confer with us and examine plans and estimates before contracting for any other pattern The Friction Condenser is now in use at the gas works located in the following places:

Portland, Me.	Brookline, Mass.	Pawtucket, R. I.	Fredericton, N. B.
Newport, R. I.	Chelsea, Mass.	Jamaica Plain, Mass.	St. John, N. B.
Gloucester, Mass.	Woburn, Mass.	Attleboro, Mass.	Paterson, N. J.
Newton & Watertown, Mass.	Peoria, Ill.	Calais, Me.	Dover, N. H.
	Clinton, Mass.	Fall River, Mass.	Waltham, Mass,

Nassau Works, Brooklyn, N. Y.

DAVIS & FARNUM MFG. CO.

MANUFACTURERS OF

Gas and Water Pipes,

AND

GAS AND WATER MACHINERY

OF THE MOST APPROVED PATTERN.

Also, Gasholders and Iron Roofing.

Orders from Gas and Water Companies promptly attended to.

WALTHAM. MASS.

Boston Office, Room 55, Mason Building, 70 Kilby Street.

Kloenne & Bredel Improved
REGENERATIVE FURNACES
Self-Sealing Mouthpieces and Bridge Pipes,
RETORT HOUSES, WASHER-SCRUBBERS,
GASHOLDERS, AND GAS WORKS COMPLETE.

Our system of heating retorts by regenerative furnaces is the simplest, most economical, most durable, and cheapest of any in use. It is the only regenerative furnace used to any extent in Great Britain, where several thousand retorts are working at the present time. In Birmingham alone 952 retorts were erected, and they are giving the best satisfaction ever obtained from any regenerative furnaces. The great advantages our benches have over all others are the following:

The generator and regenerator are independent of each other, so that any contraction or expansion of one will not interfere with the other.

The superheating surface is greater than in any other furnace yet constructed. The regenerator is absolutely self-tightening, and cannot get out of order.

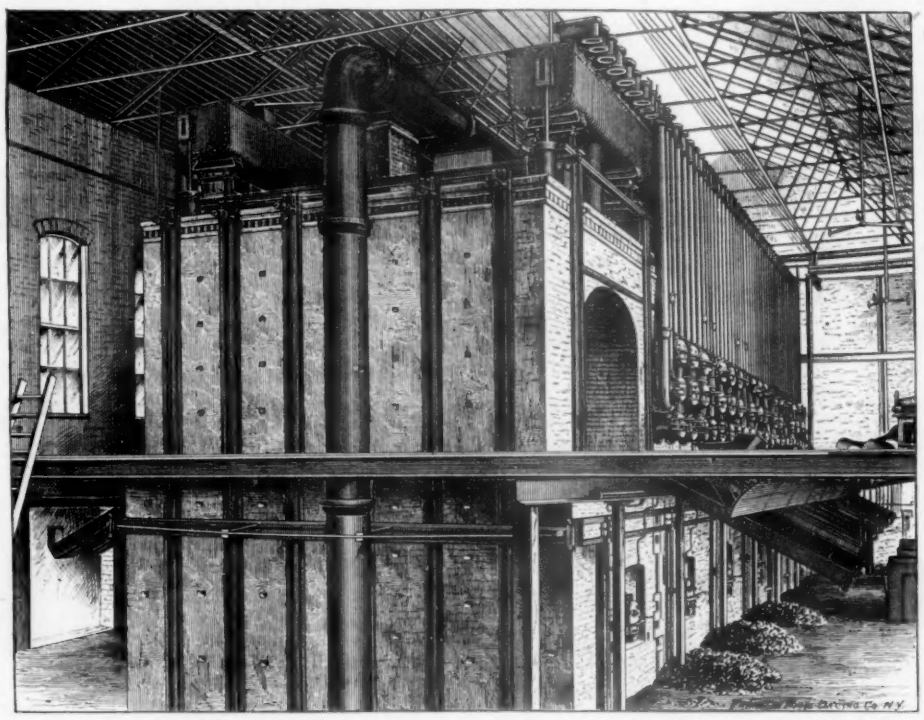
The thickness of material between the waste gases, secondary and primary air is only 1¼ inches, which increases the regenerative power from 100 to 500 per cent.

The generator is working absolutely cold, and therefore is not liable to any perceptible wear and tear.

The grate, having an enormous surface, allows the use of an inferior fuel, such as breeze, fine coke, or slack coal.

Clinkers are never formed. By an ingenious arrangement of mixing air and the steam produced by the cooling water all incombustible materials in the fuel are formed into soft ashes.

The waste gases go up through flues at 400° to 500° F. No large chimneys are required.



No cold air can enter; consequently no cracking of retorts.

The generator is inside of bench, thereby preventing any loss of heat; and stokers do not have to stand on a hot floor, as is the case where the generator projects outside of the bench.

In the past two years more than 500 retorts, with a capacity of five million cubic feet of gas per diem, have been erected in this country, and these are giving the best satisfaction, as the following testimonials will show.

We also construct half-regenerative benches, which will give the best results, and can be built in existing skeleton arches.

OFFICE OF THE NEWARK GAS LIGHT COMPANY, NEWARK, N. J., January 28, 1887.

MR. FREDERICK BREDEL, General Agent Kloenne Regenerative Furnace:

Dear Sir—The Kloenne Furnaces erected by you have been in continuous use for more than a year, and continue to give us satisfactory results. We are carbonizing 1,800 pounds coal per retort in 24 hours, and the average fuel consumption for this much has been 16.8 pounds by volume of the coke produced, or 100 pounds coal have been carbonized by 11.25 pounds hot coke. We have not lost a retort yet, and I think that those in use will give us six months' more service. Very truly, [Signed] EUGENE VANDERPOOL.

ENGINEER'S OFFICE, MILWAUKEE GAS LIGHT COMPANY, MILWAUKEE, WIS., January 26, 1887.

FRED. BREDEL, C.E.: Dear Sir—Upon your request for a testimonial for publication, I am pleased to send you the following, as I consider it deserved for the way in which your contract was carried out with us. I would say to any in the profession that among all the plans of benches presented to me from which to select I chose the "Kloenne" for several reasons. I considered it perfect in principle, that at all times it would be under absolute control, and also that each block in the regeneration could be easily seen and repaired if necessary. Your work upon our benches was done as good as it possibly could have been by anyone, and such has been the opinion of the several visitors during the progress of the work and since its completion, without exception. We have been running the furnaces since Oct. 6, and as yet have observed no cracked or sagged retorts. Every part of the work appears as perfect as when set. Although the first month was used up in experimenting and learning how to run the furnaces, and since that time we have experienced very cold weather, yet we are *selling* 26 bushels of coke (40 lbs. per bushel) per net ton of coal used. The consumption of coke in the furnaces does not exceed 20 per cent. at the present season, and for the year I am sure will be materially less.

Yours truly, [Signed] E. G. COWDERY.

OFFICE OF THE CHICAGO GAS LIGHT AND COKE COMPANY, CHICAGO, ILL., January 27, 1887.

FRED. BREDEL, Esq.: Dear Sir—We have had eight benches of nines with the Kloenne furnaces running continuously for 13 months. The results have averaged 9,000 cubic feet per mouthpiece in 24 hours, with a fuel consumption of 13 pounds coke per 100 pounds coal carbonized.

Yours truly, [Signed] THEOB'D FORSTALL, *V.-P.*

For further information apply to

FRED BREDEL,
332 East 17th Street, N. Y. City.
OR
C. F. KREISCHER,
132 Mangin Street, N. Y. City.

GIBBS
PORTLAND CEMENT

Is guaranteed to be the finest English brand, and unsurpassed by any grade imported for making concrete and setting masonry

Extract of Paper, with tests, read before the American Society of Civil Engineers, sent on application.

HOWARD FLEMING,
Sole Agent for U. S.,
23 Liberty St., New York.

MITCHELL, VANCE & CO.,

MANUFACTURERS OF

Chandeliers

and every description of

GAS FIXTURES.

Also manufacturers of Fine Gilt Bronzes and Marble Clocks, warranted best time-keepers. Mantel Ornaments, etc.

Salesrooms, 836 Broadway, N. Y.

Special Designs furnished for Gas Fixtures for Churches, Public Halls, Lodges, etc.

HOWARD FLEMING,
23 Liberty St., New York.

IMPORTER of

"BRIDGEND" "DINAS"

Silica FIRE Bricks

FOR COKE OVENS AND GAS WORKS.

PORTLAND AND ROMAN CEMENTS.

Correspondence Invited. Lowest Prices.

STEPHEN A. MORSE, President. M. B. DYOTT, EDWIN F. MORSE, Secretary.
GODFREY REBMANN, Vice-Pres. Superintendent. CARLTON M. WILLIAMS, Treas.

STANDARD GAS LAMP CO.,

Office, 411 Cherry St. Factory, 1101, 1103 & 1105 Frankford Av.

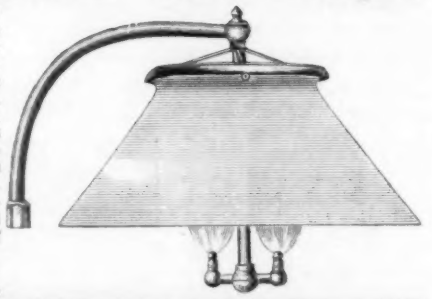
Philadelphia, Pa.

It is to the interest of Gas Companies and Cities to use Dyott's Patent Champion Lamps, which give double the light with the same consumption of gas, and will save 50 per cent. over others in cost of keeping in repair. Gas Companies and others intending to erect Lamps of any description will do well to communicate with us. Special Drawings furnished and Estimates given on application upon Architects', Engineers' or our Draughtsmen's Plans.

Our Patent System of Instantaneously Lighting Gas (without electricity) for R. R. Depots is unequaled. Our High Candle Power Burner is superior to the Electric Light or any other High Candle Burner. We manufacture every description of Ornamental Lamps.

Gregory's Retort Incandescent Gas Lamps.

Manufactured under Patents granted and applied for. **Over 20,000 sold in New York and Brooklyn. Over 100,000 sold in the U. S. in one year.** It is the only lamp that can compete with Incandescent Electric Light. Gas Companies should see that it is on sale in their city or town. They can be attached to any bracket or fixture. **A Complete Revolution in Gas Lighting.** The invention of GEO. H. GREGORY, Gas Expert. A pure white light obtained from Gas, which is **Superior to Electric Light.** All lamps are finished in nickel plate. The construction of all lamps allows the gas to be superheated before passing through the tip, rendering the illuminating properties of the gas incandescent, which causes the **Brightest Light ever obtained from Gas.** Lamps made in all sizes. Gas Companies should assist in introducing this new lamp, which exceeds all other devices for gas lighting. This Cut represents Office and Bracket Lamp. Price, **$18 per dozen**; discount 50 per cent. in half dozen lots or more. Send for Catalogue. Address



GEO. H. GREGORY, Mnfr., 337 Broadway, N. Y.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. WHYTE, who for over thirty years has made a specialty of

Holder Tank Excavation and Mason Work.

Fifty tanks now in operation show the sort of work done. Address

W. C. WHYTE, No. 15 Cortlandt St., N. Y. City.

DURING THE PAST YEAR, THE

NATIONAL GAS LIGHT AND FUEL CO.

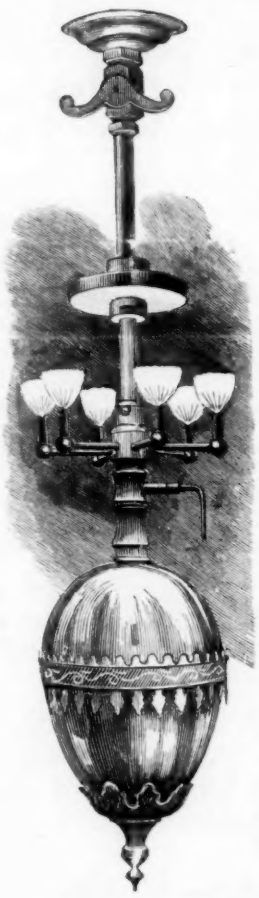
218 LA SALLE ST., CHICAGO,

Have Erected Twelve Sets of Water Gas Generating Apparatus under the *Springer Cupola* System. They are as follows:

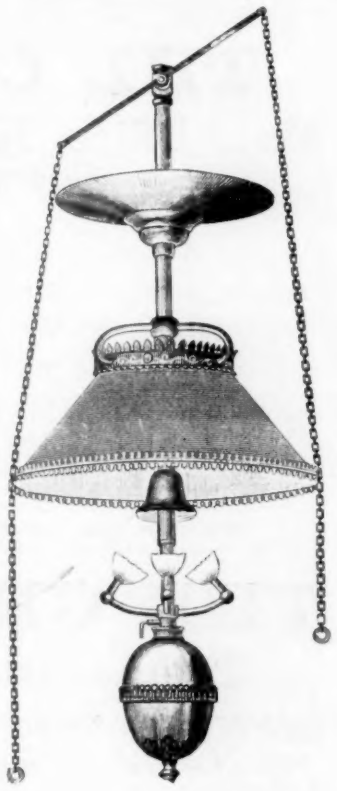
1886

Newton Illuminating Company, Newton, Kansas.— Daily capacity, 120,000 cu. ft.
Wellington Light & Heat Co., Wellington, Kansas.— Daily capacity, 120,000 cu. ft.
Chippewa Falls, Gas Light Co., Chippewa Falls, Wis.— Daily capacity, 120,000 cu. ft.
Elkhart Gas Light & Coke Co., Elkhart, Indiana.— Daily capacity, 120,000 cu. ft.
Madison City Gas Light Company, Madison, Wis.— Daily capacity, 120,000 cu. ft.
South Bend Gas Light Co., South Bend, Indiana.— Daily capacity, 250,000 cu. ft.
Sheboygan National Gas Comp'y, Sheboygan, Wis.— Daily capacity, 120,000 cu. ft.
Salina Gas Light Company, Salina, Kansas.— Daily capacity, 120,000 cu. ft.
Rathbun Company, Deseronto, Province Ontario.— Daily capacity, 80,000 cu. ft.
Jefferson City Gas Light Co., Jefferson City, Mo.— Daily capacity, 120,000 cu. ft.
Mankato Gas Light Company, Mankato, Minnesota.— Daily capacity, 80,000 cu. ft.
Minneapolis Gas Lt. & Coke Co., Minneapolis, Minn.— Daily capacity, 1,000,000 cu. ft.

1886



THE ALBO-CARBON LIGHT.



This most successful of all methods of enriching gas is based on the use of heated gas to vaporize a solid hydrocarbon, thus

COMBINING THE ADVANTAGES OF PREHEATING AND CARBURETTING.

The incoming gas passes over an extended heating surface (heated by means of the illuminating flames), and is raised to the temperature necessary to vaporize the carburetting material, which is a white, crystalline solid prepared from coal tar.

WRIT OF INJUNCTION.

In the suit between this Company, as complainant, and Newman A. Ransom *et al.*, defendants, pending in the Circuit Court of the United States for the Northern District of Illinois, on a late hearing of said cause before his Honor, Judge Gresham, Judge of said Court, an order was made and entered therein, supporting our charge of infringement of our Letters Patent No. 247,925, dated October 4, 1881, and No. 333,862, dated January 5, 1886, and sustaining our rights under said several Letters Patent, and an injunction was issued thereon, a copy of which is hereto annexed, and to which especial attention is hereby directed, viz.:

INJUNCTION WRIT.

Circuit Court of the United States of America, Northern District of Illinois, } ss.

THE UNITED STATES OF AMERICA,

To Newman A. Ransom, and to your Counselors, Attorneys, Solicitors, Trustees, Clerks, Servants, and Agents, and to each and every of them, *Greeting:*

WHEREAS, it hath been represented to the Judges of our Circuit Court of the United States for the Northern District of Illinois, in Chancery sitting, on the part of Walter J. Kidd, Complainant in his certain bill of complaint, exhibited in our said Circuit Court, on the Chancery side thereof, before the Judges of said Court, against you, the said Newman A. Ransom, to be relieved touching the matters complained of. In which said bill it is stated, among other things, that you are combining and confederating with others to injure the Complainant touching the matters set forth in the said bill, and that your actings and doings in the premises are contrary to equity and good conscience. And it being ordered that a writ of injunction issue out of said Court, upon said bill, enjoining and restraining you, and each of you, as prayed for in said bill. We, therefore, in consideration thereof, and of the particular matters in said bill set forth, do strictly command you, the said Newman A. Ransom, your Counselors, Attorneys, Solicitors, Trustees, Clerks, Servants, Agents, and each and every of you, that you DO ABSOLUTELY DESIST AND REFRAIN FROM the making, using, or selling of any Carburetting Attachments for gas fixtures substantially as described and claimed in Letters Patent numbers 247,925 and 333,862, to wit: the second claim of said Letters Patent number 247,925 and the first and second claims of said Letters Patent number 333,862, until this Honorable Court, in Chancery sitting, shall make other order to the contrary. Hereof fail not, under the penalty of what the law directs.

To the Marshal of the Northern District of Illinois, to execute and return in due form of law.

[SEAL.]

WITNESS, the HON. MORRISON R. WAITE, Chief Justice of the Supreme Court of the United States of America, at Chicago, in said District, this 19th day of January, in the year of our Lord one thousand eight hundred and eighty-seven, and of our Independence the one hundred and eleventh year.

WM. H. BRADLEY, Clerk.

Marshal's Return.

United States of America, Northern District of Illinois, } ss.

I have served the within writ on the within defendant, Newman A. Ransom, by reading the same to and within his presence, and by delivering to him a true copy of the within, this 19th day of January, A. D., 1887.

F. H. MARSH, Marshal,
By IRA BARCHARD, Deputy.

Our suit against W. S. Horry (formerly trading as the Crystal Carbon Light Co.), Arthur Kitson (now trading as the Crystal Carbon Light Co.), and others, defendants, for infringement of our Letters Patent above mentioned and referred to, pending in the Circuit Court of the United States for the Eastern District of Pennsylvania, has not yet been reached for hearing.

THE ALBO-CARBON LIGHT COMPANY, - - - NEWARK, N. J.,

Sole Manufacturers for the United States.

GAS ENGINES. GAS LAMPS. BOOKS.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time.

Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

TRADE MARK.

THE CRYSTAL CARBON LIGHT!

The Latest and Most Improved Gas Light!

ADAPTED FOR PRIVATE RESIDENCES, CHURCHES, THEATERS, STORES, ETC.

These Burners are manufactured on the principle of enriching gas by means of Naphthaline (so-called Crystal Carbon or Albo-Carbon), the invention of the Rev. W. R. Bowditch, F.R.S., of Wakefield, England, who was the original inventor and patentee of this system of gas lighting.

SPECIAL NOTICE.

Many Gas Companies find the Crystal Carbon Light a valuable competitor against the Electric Light. It is ornamental, free from the defects common to all other enriching gas burners, and is as cheap as ordinary gas chandeliers. We sell direct to gas companies, giving them the benefit of agents' discounts.

CARBONCRYSTAL.

(Trade Mark.)

A new and superior preparation for enriching gas used in conjunction with Crystal Carbon or Albo-Carbon gas lights. The preparation is cleaner and better adapted for filling burner vessels than any hitherto produced. Guaranteed to be chemically pure. Supplied in cans from 10 pounds up.

THIS IS THE CHEAPEST AND PUREST FORM OF ENRICHING MATERIAL.

CRYSTAL CARBON LIGHT CO.,

Main Office, No. 1018 Chestnut Street, Philadelphia, Pa.

GAS

AS A SOURCE OF

LIGHT, HEAT, AND POWER.

By C. J. R. HUMPHREYS.

A Pamphlet of twenty-nine pages, treating of the use of Gas as a source of Light, Heat, and Power.

DESIGNED FOR DISTRIBUTION BY GAS COMPANIES AMONG THEIR CUSTOMERS AND OTHERS.

Price, 10 cents each, $5 per 100, $50 per 1,000.

Gas Companies can have their own imprint placed on cover without extra charge. All orders to be sent to

A. M. CALLENDER & CO.,

No. 42 Pine Street, N. Y. City.

GAS EXHAUSTERS

Have long been regarded as "luxuries" not to be thought of by small companies; but

CONNELLY'S JET EXHAUSTER IS WITHIN THE REACH OF ALL!

Will Pay for Itself in Six Months! Saves Labor! Lengthens the Lives of Retorts! Prevents the Formation of Carbon! Increases the Yield from Twelve to Fifteen Per Cent.!

We find, after careful inquiry and investigation, that the majority of the Gas Works in the United States and Canada are running *without Exhausters*, which, in our opinion is due to two causes. *First.* The prices heretofore asked for Exhausters have been so high as to counteract, to a great extent, the advantages to be obtained from their use, and caused most managers to postpone their adoption indefinitely, or until their consumption had largely increased. *Second.* Many superintendents have a false impression that it will not pay to run an Exhauster in works producing less than 20,000 feet per day.

The first difficulty we overcome by selling our Exhausters at *extremely low prices*, as will readily be admitted after comparing our list with those of other manufacturers; and as to the second, we can say we have most convincing evidence from many companies operating our Exhausters that they can be used to advantage in works producing *as low as* 6,000 *cubic feet per day.*

In our improved Exhauster we combine the "Exhaust Tube" Gas and Steam Governors, Gas Compensator, and Bye-Pass Valves in the most compact form possible, which is a very great advantage to the machine, besides enabling us to manufacture and sell at the low prices given.

This is the only Exhauster in the market having a "compensator" in addition to the "gas governor"—a most important improvement, as it does away with all possible danger of their ever drawing air, and thus reducing the illuminating power of the gas.

FOR OIL GAS WORKS.

Our Exhausters are especially adapted for the use of Oil Gas Works; and where oil is required to dilute the gas a valve can be adjusted *to take the exact amount of air required*, thus dispensing with air pumps and their attendant labor and annoyance.

POINTS OF SUPERIORITY.

Requires *one-half the floor space* and *one-third less steam* than any other Exhauster in the market of same capacity. *More cheaply and easily connected*, as outside "Bye-Pass Valves" are dispensed with. It is the only Exhauster manufactured having "Compensator" and "Governor" *combined*, the "Compensator" with all other Exhausters being a separate and distinct machine. It is simple in construction, easily adjusted, not liable to get out of order, and *can be operated by ordinary workmen.*

NAPHTHALINE AND STEAM JET EXHAUSTERS.

As many superintendents of Gas Works believe the use of a Steam Jet Exhauster will inevitably cause trouble from *naphthaline* deposits, we recently sent out letters of inquiry to superintendents using our Steam Jet, asking for their experience, and the following replies speak for themselves. That naphthaline deposits are often unjustly attributed to Jet Exhausters is well known by many superintendents. When the cause cannot be determined it seems to be the rule to place the responsibility on the Jet Exhauster, *if they have one;* but if no Exhauster is used *the cause remains a mystery.*

OFFICE LISTOWEL GAS LT. CO., LISTOWEL, CAN., May 29, 1885.

Messrs. Connelly & Co., Ltd.: Gentlemen—The Exhauster purchased from you over three years ago, and now in use, has proven in every way all you claim for it, and has given us great satisfaction. No trouble has arisen from naphthaline.

Yours respectfully, F. W. HAY, Sec.

RICHMOND GAS CO., RICHMOND, KY, June 1, 1885.

Messrs. Connelly & Co., Ltd., 407 Broadway, N. Y: Gentlemen—I put in your Steam Jet Exhauster last November. I think it a perfect machine, as it requires no attention whatever. Have not had any naphthaline to contend with; it would be very easy to get rid of that substance if I had it. Yours very truly, J. B. GORDON, Supt.

HAMPTON, VA., June 3, 1885.

Messrs. Connelly & Co., Ltd.: Gents—We have been using your Steam Jet Exhauster for the past 3 years, and have never had any trouble with it whatever, either from naphthaline or any other source. Yours truly, J. B. H. GOFF.

BRUNSWICK, ME., May 27, 1885.

Messrs. Connelly & Co., Ltd.: Dear Sirs—Your favor of 23d inst. at hand. In answer would say your Exhauster works well with us. We make an oil gas; are not troubled with naphthaline. Very truly yours, B. G. DENNISON, Prest. Brunswick Gas Lt. Co.

WILMINGTON, O., June 15, 1885.

Messrs. Connelly & Co., Ltd.: Dear Sirs—We started your make of six-inch Steam Jet Exhauster March 30, and I am pleased to state, from the time the steam was turned on, it has performed its work to our entire satisfaction. We have never had any other but a Steam Jet Exhauster, and have never been troubled with naphthaline. For many reasons I prefer it to the "rotary," and have no hesitancy in recommending it.

Yours truly, E. W. HAMLIN, Sec. Gas Co.

OFFICE LOGAN GAS LT. & COKE CO., LAGAN, HOCKING CO., O., May 29, 1885.

Connelly & Co., Ltd.: Gentlemen—In answer to yours of 27th we have to say that the Steam Jet Exhauster put in for us by you last fall has been used constantly since, and, up to this time, we have had no trouble with naphthaline. We have heard many gas men say that a Steam Set Exhauster is liable to bring on trouble with naphthaline, and we have had that fear before us; but so far we have escaped, and we trust we may not have any experience with that gas manager's bugbear. Yours truly,

LOGAN GAS LT. & COKE CO.

OFFICE ATHENS GAS LT. CO., ATHENS, O., May 30, 1885.

Messrs. Connelly & Co., Ltd.: Dear Sirs—We take pleasure in giving you an unqualified endorsement of your Steam Jet Exhauster. It has been in place almost a year; been tested in all seasons and under all conditions; it has always proved true to the work assigned it. We have had no naphthaline deposit, nor any trouble chargeable to the Exhauster. Nothing but good has come from it, and *great* good at that. We can't do without it. Very truly yours, C. H. WELCH, Supt.

OFFICE MEADVILLE GAS WORKS, MEADVILLE, PA., May 29, 1885.

Connelly & Co., Ltd.: Gents—Yours of the 27th received and contents noted. Would say that after using your Steam Jet Exhauster for the past 18 months, find it perfectly satisfactory in every way. So far as naphthaline is concerned, we have had no trouble whatever as yet. Yours, GEO. S. CULLUM, Supt.

NYACK AND WARREN GAS LT. CO., NYACK, N. Y., May 25, 1885.

Connelly & Co., Ltd.: Gentlemen—Since your Jet Exhauster has been here there has been no trouble, and certainly *no naphthaline.* The only trouble I have experienced was the Jet becoming clogged with tar last week, and I cleaned it in a few minutes. It has run over three years without any trouble or cost for repairs. Yours truly,

A. MURRAY, Lessee and Manager.

OFFICE CADIZ GAS LT. CO., CADIZ, O., May 29, 1885.

Messrs. Connelly & Co., Ltd.: Gentlemen—Yours of 23d, inquiring how our Steam Jet Exhauster is doing, has been received. We have been using one of your Exhausters about four years, and with the best of satisfaction. We have less trouble with carbon in retorts, make more gas from same amount of coal than before, and have no trouble with stoppage in pipes or trouble from tar; and as regards naphthaline, we are not troubled with it, and do not know what it is to have any stoppage in pipes from naphthaline.

Very truly yours, A. N. HAMMOND, Sec.

SIDNEY (OHIO) GAS WORKS, June 1, 1885.

Connelly & Co., Ltd.: Gentlemen—We have now been using one of your Steam Jet Exhausters about five months, and thus far it has given us perfect satisfaction. We get a better yield and a more brilliant quality of gas from the coal. We have seen in papers and heard from different individuals that Steam Jet Exhausters were productive of naphthaline. "*We can't see it,*" as we have found no trace of it in the works, mains, services, or meters. Respectfully yours, W. W. GRAHAM, Supt.

CONNELLY & CO., LTD., No. 17 Broadway, New York City.

T. C. HOPPER'S

AUTOMATIC DIFFERENTIAL GAS GOVERNOR

Is now in Practical Operation, doing Perfect Automatic Service with Great Precision.

This Governor will do all and more than any other Governor on the Market.

BE SURE TO THOROUGHLY INVESTIGATE THE SUPERIOR MERITS OF THIS GOVERNOR BEFORE PURCHASING.

For Simplicity and Reliable Work it has no Equal. Correspondence Solicited.

T. C. HOPPER & CO., - - Manufactory, 2227 Wood Street, Phila, Pa.

G. S. COOK, Pres. THOS. DAVENPORT (late Davenport Bros.), Sec. & Treas

BARTLETT Street Lamp Mfg. Co.

MANUFACTURERS OF

Bartlett's Patent

GLOBE LAMPS,

FOR

Streets, Parks, Railroad Stations, Public Buildings, Etc.

LAMP POSTS A SPECIALTY.

Office and Salesroom

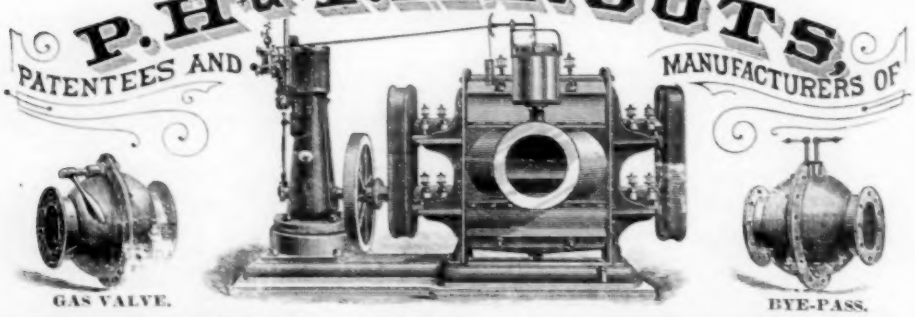
No. 35 Howard Street, N. Y. City.

Gas Companies and others intending to erect lamps and posts will do well to communicate with us.

F. M. ROOTS. S. C. ROOTS D. T. ROOTS.

P. H. & F. M. ROOTS,

PATENTEES AND MANUFACTURERS OF



GAS VALVE. BYE-PASS.

IMPROVED GAS EXHAUSTER,

WITH ENGINE ON SAME BED PLATE, OR WITHOUT.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, Etc., FURNISHED TO ORDER.

P. H. & F. M. ROOTS, Patentees & Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 22 Cortland St.

COOKE & CO., Selling Agents, 22 Cortland St., N. Y.

SEND FOR ILLUSTRATED CATALOGUE AND PRICE LIST.

CONNELLY & CO., LTD.

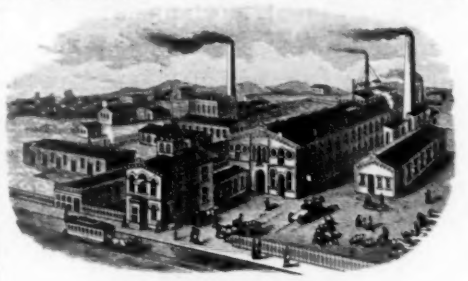
MANUFACTURERS OF

Steam-Jet Exhausters

Requires one-half the flo r space and one-third less steam than any other Exhauster in the market. More cheaply and easily connected, as outside by-pass valves are dispensed with. It is the only Exhauster manufactured having Compensator and Governor combined; the Compensator with all other Exhausters being a separate and distinct machine. It is simple in construction, easily adjusted, not liable to get out of order, and can be operated by ordinary workmen. Over **1,000 now in use.**

No. 177 Broadway, New York.

LUDLOW VALVE MFG. CO.



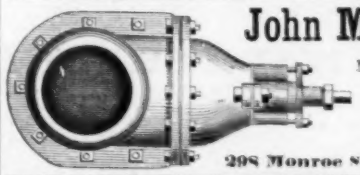
OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av. TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants.

Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. nd for Circulars.



John McLean

Man'facturer of

GAS VALVES.

298 Monroe Street, N. Y.

GAS vs. ELECTRIC LIGHT.

We would invite attention to the able and exhaustive argument of General A. Hickenlooper, President of the Cincinnati Gas Light and Coke Company, contained in a handsome pamphlet of 96 pages, entitled

"EDISON'S INCANDESCENT ELECTRIC LIGHTS FOR STREET ILLUMINATION. REPORT OF AN ARGUMENT DELIVERED BY A. HICKENLOOPER BEFORE THE COMMITTEE ON LIGHT, MUNICIPAL COUNCIL, CITY OF CINCINNATI, JULY 22, 1886."

This is a subject of special interest to all Gas Light Companies.

Prices.

25 copies.....	$7.50	100 copies.....	$22.50
50 copies.....	12.50	250 copies.....	50.00

A sample copy will be sent by mail on receipt of 50 cts.

A. M. CALLENDER, & CO., 42 PINE ST., N. Y. CITY.

C. W. HUNT CO.,

No. 111 Broadway, N. Y. City.

MANUFACTURERS OF

Coal Handling Machinery,

AUTOMATIC RAILWAY, HOISTING ELEVATOR, CABLE RAILWAY, STEAM SHOVEL, HOISTING ENGINES, COAL TUBS, COAL & COKE CARS.

Plans and Specifications made for the

Erection of Coal Storage Buildings

Send for a Descriptive Pamphlet.

GAS STOVES. GAS STOVES. GAS STOVES.

THE AMERICAN METER CO.,

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. Nos. 122 & 124 Sutter Street, San Francisco Cal

No. 810 North Second Street, St. Louis, Mo.

Open Fire Place Heater No. 19.
Fitted with the new Incandescent Gas Fire.

NEW

INCANDESCENT

Gas Fires

AND

OPEN

Fire Place

Heaters.

Open Fire Place Heater No. 17C.
Fitted with Illuminating Burners and Copper Reflectors.

We call attention to Special Apparatus Heated by Gas for Manufacturing Purposes.

GAS FURNACES FOR TINMEN'S USE; FURNACES FOR MELTING SOLDER AND TYPE METAL; APPARATUS FOR BENDING CARRIAGE PANELS, NOW IN SUCCESSFUL OPERATION IN CARRIAGE MANUFACTORIES; WATER HEATERS FOR KITCHEN BOILERS, BATHS, ETC., AND FOR ATTACHING TO HEATING COILS AND PIPES FOR CONSERVATORIES.

THE COMPANY MANUFACTURE

GAS STOVES FOR COOKING AND HEATING PURPOSES

In all Sizes, for Domestic, Restaurant, and Hotel Use.

These Stoves may be seen in operation at our Retail Store, No. 223 Sixth Avenue, N Y. Call and examine.

SEND FOR CATALOGUE OF TWENTY DIFFERENT STYLES OF HEATING STOVES.

RETORTS AND FIRE BRICK.

J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

JERSEY CITY, N. J.

MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

J. H. GAUTIER. T. B. GAUTIER.
C. E. GREGORY. C. E. GAUTIER.

BROOKLYN

Clay Retort & Fire Brick Works,

(EDWARD D. WHITE & CO.)

Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.

VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.

Office, 88 Van Dyke St., Brooklyn, N. Y.

RETORTS AND FIRE BRICK.

LACLEDE FIRE BRICK MFG. CO.,

MANUFACTURERS OF

Fire Brick, Gas Retorts,

AND

ST. LOUIS STANDARD SEWER PIPE.

Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.

OFFICE AND DEPOT

901, 903, and 905 Pine Street,

ST. LOUIS, MO.

ESTABLISHED IN 1845.

B. KREISCHER & SONS,

OFFICE FOOT OF HOUSTON ST., E.R., N.Y.

Gas Retorts,

TILES, FIRE BRICK.

AND EVERYTHING IN THE FIRE CLAY LINE.

RETORTS AND FIRE BRICK.

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS.

ADAM WEBER.

CLAY GAS RETORTS

AND RETORT SETTINGS

FIRE BRICKS, TILES, ETC.,

Office and Works, 15th Street and Avenue C., N. Y.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Office, Rooms 19 & 20, Lewis Block,
PITTSBURGH, PA. P. O. Box 373.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

CHAS. H. SPRAGUE & SON, No. 70 KILBY STREET, BOSTON, MASS., Agents for the New England States.

OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1836. WORKS, PERTH AMBOY, NEW JERSEY.

HENRY MAURER & SON,

Excelsior Fire Brick & Clay Retort Works

CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

CHICAGO

Retort & Fire Brick Works,

OFFICE AND FACTORY,
Clark, Forty-Fifth, and La Salle Streets,
CHICAGO, ILL.

GEORGE C. HICKS, Pres. PAUL P. USTIN, Sec. & Treas.

STANDARD

Clay Retorts and Settings.

BLOCKS & TILES

Of every Shape and Size to Order.

Standard Fire Bricks.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address

C. L. GEROULD,
Manchester, N. H.
Western Agent, H. T. GEROULD, Mendota, Ill.

OAKHILL

GAS RETORT & FIRE BRICK

Works.

Proprietors,

PARKER-RUSSELL MINING & MFG. CO.

City Office, 711 Pine Street,

ST. LOUIS, MO.

Our immense establishment is now employed almost entirely in the manufacture of

MATERIALS FOR GAS COMPANIES.

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. Ou customers are in almost every State of the Union, to all of whom we refer.

Thos. Smith, Prest. August Lambla, Vice-Prest. & Sup

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Connection with the City by Telephone.

Clay Retorts, Blocks & Tiles,

FIRE BRICK, FIRE CLAY,

AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 88 WATER ST., BOSTON, MASS

Sole Agents the New England States

RETORTS AND FIRE BRICK.

EVENS & HOWARD,

916 Market St., St. Louis. Mo.

Works, Howard Station, Mo. Pacific R.R.

Fire Brick, Gas Retorts

AND

RETORT SETTINGS.

Sewer Pipe, 3 to 24 in. diameter.

Glass Pot Clay, Ground Fire Clay, in barrels and in bulk. All kinds of Fire Clay Goods.

Cincinnati Gas Retort & Fire Brick Works.

—*ESTABLISHED* 1872.—

CHAS. TAYLOR,

MANUFACTURER OF

Gas Retorts, Fire Brick, and Tile.

Blast Furnace Linings, Cupola Blocks, Boiler Tiles, Grate Settings, and Stove Linings. Fire Cement, Fire Clay, Fire Sand, and all other Fire Clay Goods.

Branch Works, New Cumberland, W. Va.

GENERAL OFFICE AND WORKS,

Burns St., Cincinnati, Ohio.

Stettiner Chamotte Fabrik Actien Gesellschaft,

Formerly DIDIER,

(Patentees of the Dr. Schilling & Dr. Bunte Regenerative Furnace)

STETTIN, GERMANY.

The attention of all Gas Engineers is called to our Fire-Proof Material, viz.:

CLAY GAS RETORTS

(ENAMELED AND UNENAMELLED),

Blocks, Tiles

AND

EXTRA FIRE BRICK,

Pronounced by the highest authorities as superior to and excelling any other similar manufacture. The component of aluminum contained in our material (up to 45 per cent.) is larger than in any other material heretofore sold in the United States; whilst the uniformity of the goods is assured by the most scrupulous analysis of the clay used.

For any further information and prices please apply to

EMIL LENZ,

2 & 4 Stone St., Room 19, N.Y. City.

JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting,

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REGENERATIVE FURNACES.

ADAM WEBER'S

New and Improved Regenerative Furnace.

ESPECIALLY ADAPTED FOR USE IN SMALL GAS WORKS.

A Saving of at Least Forty per Cent. over Old Methods.

Cheapness of construction and absence of elaboration are the chief characteristics of this Furnace. It is also applicable in cases where it is not convenient to excavate deeply below the line of the retort house.

Correspondence respectfully solicited. Descriptive Circulars on application.

Manhattan Fire Brick & Enameled Clay Retort Works.

OFFICE, 633 EAST FIFTEENTH STREET, N. Y. CITY.

MUNICH REGENERATIVE FURNACE

System Drs. Schilling and Bunte.

Greatest Durability! Minimum of Attention!

COMPLETE DISTILLATION IN 3½ HOURS.

Ten to Thirteen Pounds of Coke to Hundredweight of Coal.

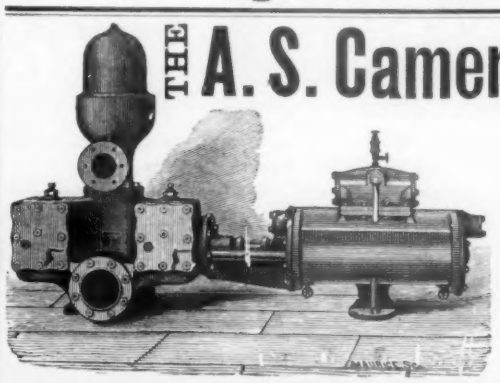
NO CLINKER. NO CARBONIC OXIDE IN THE REGENERATIVE FLUES.

Almost Automatic in Action.

The Most Successful Regenerative Furnace in Use.

BARTLETT, HAYWARD & CO.

Agents for the United States.



THE A. S. Cameron Steam Pump,

THE STANDARD OF EXCELLENCE.

Upward of 30,000 in Use.

BEST GAS WORKS PUMP

Ever Introduced.

Adapted to Every Possible Duty.

A. S. Cameron Steam Pump Works.

Foot East 23d St., N. Y.

GEO. SHEPARD PAGE,

No. 69 Wall Street, N. Y. City.

REPRESENTING

THE BOWER GAS LAMP.

C. & W. Walker's Carbonic Acid & Tar Extracting Washer

B. DONKIN & CO.'S PAT. IMP. GAS VALVE.

Young & Beilby's Patents. Henry Aitkin's Patents.

R. P. SPICE, London, Eng. HENRY SIMON, Manchester, Eng.

GAS AND WATER PIPES. GAS AND WATER PIPES. ENGINEERS.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Treas.

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders, &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N. J.
NEW YORK OFFICE, 162 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 436-1

MATTHEW ADDY, President. W. L. DAVIS, Selling Agent. GEO. P. WILSHIRE, Sec. & Treas.

Cincinnati and Newport Iron and Pipe Company,

NEWPORT, KY.

Lamp Posts AND **BENCH CASTINGS** A Specialty.

Large & Heavy Castings for General Work.

Branch AND SPECIAL CASTINGS FOR GAS & WATER CO'S.

Manufacture Pipe from 2 to 48 inches. All work guaranteed first quality.

Pancoast & Rogers.

WROUGHT IRON PIPE,

VALVES AND GATES,

Cast Iron Gas & Water Pipe.

28 Platt and 15 Gold St., New York.

The Management of Small Gas Works.

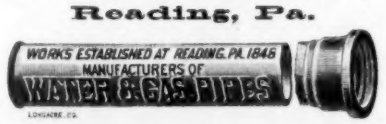
By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

P. D. WANNER, Chairman. A. H. MELLERT, Sec. & Treas.

MELLERT FOUNDRY & MACHINE CO., Ltd.

Reading, Pa.



Specials—Flange Pipe, Valves and Hydrants, Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y.**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

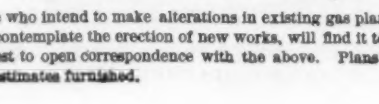
BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

M. J. DRUMMOND,



SPECIAL CASTINGS AND LAMP POSTS.

95 Liberty St., - New York.

JOS. R. THOMAS, C.E.,

May be Consulted on all Matters Relating to Gas Works and Gas Manufacture.

ADDRESS THIS OFFICE.

WM. FARMER, ENGINEER,

32 Park Place, Room 36, New York.

THE CHEMIST'S ASSISTANT; OR, KINDERGARTEN SYSTEM OF CHEMISTRY.

A system by which the elements and their valences are represented by illustrations and solid bodies.

BOX AND PAMPHLET COMPLETE, $2.50.

WM. HENRY WHITE,

CONSULTING AND CONSTRUCTING

Gas Engineer & Contractor

Estimates, Plans, and Specifications furnished for new wo extensions of existing works.

No. 32 Pine Street, New York City.

Correspondence solicited.

WM. GARDNER,

Gas Engineer,

Lewis Block, Room 20, Pittsburgh, Pa.

Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find it to their interest to open correspondence with the above. Plans made and estimates furnished.

GAS LAMPS. SCRUBBERS AND CONDENSERS.

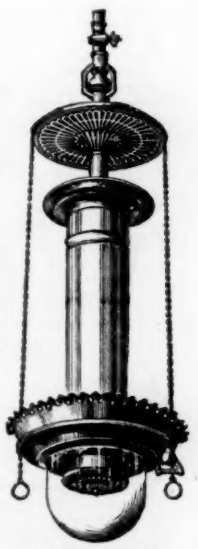
SIEMENS LAMP.

The Siemens and Lungren

REGENERATIVE GAS LAMPS.

A System of Burning Gas whereby its Illuminating Power is Increased fron 300 to 400 per ct. without the Expense, Trouble and Annoyance resulting frow the use of Hydrocarbon Enriching Material.

The Siemens-Lungren Company received the only Silver Medal or Highest Award for Gas Burners at the "Novelties" Exhibition of the Franklin Institute, held at Phila., Oct., '85.



LUNGREN LAMP

THIRTEEN CANDLE POWER PER CUBIC FOOT OF GAS!

This result is obtained

SIMPLY BY THE SCIENTIFIC APPLICATION OF THE REGENERATIVE PRINCIPLE.

Consequently this largely increased illumination is always maintained without further cost and frequent attention.

THE SIEMENS-LUNGREN COMPANY,

N. E. Cor. 21st. St. and Washington Av., Phila., Pa.

THE PATENT "STANDARD" WASHER-SCRUBBER

Has been adopted by gas companies in all parts of the world. Between 300 and 400 companies, with the enormous daily output of over 300,000,000 cubic feet, are now using it. "Standard" Washer-Scrubbers have been erected for the following gas light companies since Jan. 1, 1886:

WALLASEY, ENGLAND	750,000 cubic feet.	RICHMOND, SURREY, ENGLAND	1,500,000 cubic feet.
NEWARK, ENGLAND	350,000 "	BRIDGEPORT, U. S.	500,000 "
BUFFALO, U. S. (MUTUAL)	500,000 "	TORONTO, CANADA	1,000,000 "
BERLIN, GERMANY	1,250,000 "	HARTFORD, U. S.	1,000,000 "
SO. BRISBANE, AUSTRALIA	300,000 "	DETROIT, U. S.	750,000 "
LEEDS, ENGLAND	2,000,000 "	SINGAPORE, CEYLON	300,000 "
FURTH, GERMANY	400,000 "	BRUNSWICK, GERMANY	300,000 "
FREIBURG, GERMANY	200,000 "	LILLE, FRANCE	750,000 "
NINE ELMS, LONDON	3,000,000 "	CADIZ, SPAIN	300,000 "
MELBOURNE, AUSTRALIA (2)	3,000,000 "	READING, ENGLAND	2,000,000 "
GLUCKAUF COKE WORKS, GERMANY.	200,000 "	LINCOLN, U. S.	250,000 "
BOURNEMOUTH, ENGLAND	1,000,000 "	ST. LOUIS, U. S. (LACLEDE)	1,000,000 "
		BROOKLYN, U. S.	2,000,000 "

That this apparatus is really the *standard* is indicated by the following names of important houses who represent this invention in the different countries of the world:

FRANCE & BELGIUM, Mons. J. A. Berly, 31 Rue Boinod, Paris. HOLLAND & DUTCH COLONIES, Mess. W. Hoven & Zoon, Rotterdam.
GERMANY and AUSTRO-HUNGARY, Berlin-Anhaltische-Actiengeselschaft, Berlin, Moabit, and Dessau.
RUSSIA, Mr. F. Bley, Galernaya, 44, St. Petersburg. SPAIN, Mess. Nicolas, Chamon, Foiret & Cie., 29 Rue Claude-Vellefaux, Paris.
ILALY & MALTA, Sig. E. Canziani, 26 & 28 Portici, Vittorio Emmanuele, Genoa. Sig. Fratelli Scheuer, Via Chiaja, 124, Naples.
NEW SOUTH WALES, Messrs. W. Coward & Sons, 143 Queen Victoria St., London.
NEW ZEALAND and VICTORIA, Messrs. G. D. Jennings & Co., 28 Gracechurch St., London.

Companies in the U. S. adopting this apparatus can now be assured of a market for the Ammoniacal Liquor at a remunerative price. Correspondence for purchase of "Standards" and Ammoniacal Liquor is solicited by the

SOLE AGENT AND MANUFACTURER FOR THE WESTERN HEMISPHERE,

GEO. SHEPARD PAGE, 69 WALL STREET, NEW YORK

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

WORKS: { MILLVILLE, N. J. / FLORENCE, " / CAMDEN, "

R. D. WOOD & CO.,

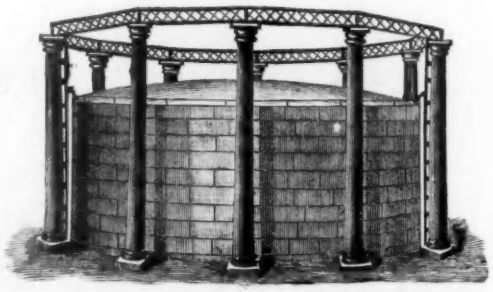
OFFICES: { 400 CHESTNUT ST., / PHILADELPHIA.

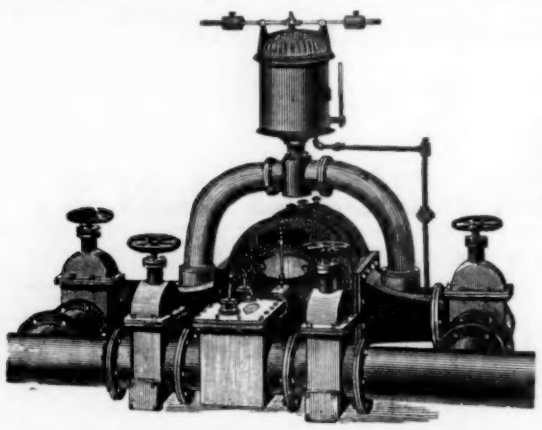
CAST-IRON PIPE 1½ to 72 Inches in Diameter.

Water Machinery and Gas Apparatus. **HEAVY CASTINGS.**

HOLDERS, PURIFIERS, FLOORS AND ROOFS,
LAMP POSTS, CONDENSERS, FLANGED PIPE,
VALVES, BENCH WORK, FIRE HYDRANTS,
METER CASES.

Estimates and Specifications for NEW WORKS or EXTENSIONS or ALTERATIONS of OLD ONES.





SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.

SOUTHWARK FOUNDRY AND MACHINE COMPANY,

Successors to MERRICK & SONS,

GAS APPARATUS,

Holders, Purifiers, Washers, Etc., Etc. Boiler and Tank Work. Steam Engines. Hydraulic Machinery. Bessemer Plants, Etc.

Washington Ave. and Fifth Street, Philadelphia, Pa.

MORRIS, TASKER & CO.,

Limited,

Builders of Gas Works,

PHILADELPHIA PA.

GOODWIN'S DIRECTORY

OF THE

GAS LIGHT COMPANIES OF THE UNITED STATES & CANADA

Price, ... $10.00.

Orders may be sent to

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

JAMES R. FLOYD,

(SUCCESSOR TO HERRING & FLOYD)

Oregon Iron Works,

531 to 543 West 20th St., N. Y.

Practical Builders of Gas Works,

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS-WORKS.

BENCH CASTINGS from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS; CONDENSERS; SCRUBBERS wet and dry), and

EXHAUSTERS for relieving Retorts from pressure.

BENDS and BRANCHES all sizes and description.

FLOYD'S PATENT MALLEABLE RETORT LID.

PATENT SELF-SEALING RETORT LIDS.

FARMER'S PATENT BYE-PASS DIP-PIPE.

SABBATON'S PATENT FURNACE DOOR AND FRAME.

BUTLER'S COKE SCREENING SHOVELS.

GAS GOVERNORS,

nd everything connected with well regulated Gas Works at ow price, and in complete order.

SELLER'S CEMENT for stopping leaks in Retorts.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.

Plans, Specifications, and Estimates furnished.

KERR MURRAY MFG. CO.,

MANUFACTURERS OF

Single Lift and Telescopic

GASHOLDERS.

Built, 1884:

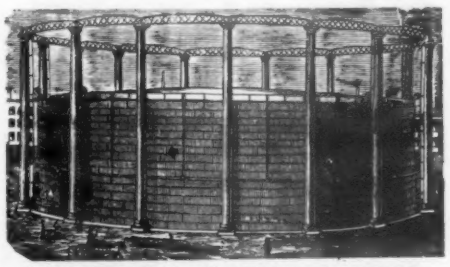
Altoona, Pa	Capacity,	160,000	cubic feet.
Pittsburgh, Pa	"	250,000	"
" "	"	220,000	"
Bellaire, Ohio	"	50,000	"
Youngstown, Ohio	"	60,000	"
Canton, "	"	60,000	"
Akron, "	"	80,000	"
Xenia, "	"	10,000	"
Adrian, Mich	"	65,000	"
Ypsilanti, Mich	"	25,000	"
Muskegon, "	"	70,000	"
South Bend, Ind	"	70,000	"
Anderson, "	"	20,000	"
Plainfield, "	"	10,000	"
Springfield, Illinois	"	100,000	"
Evanston, "	"	50,000	"
Freeport, "	"	35,000	"
Elgin, "	"	60,000	"
Sheboygan Wis	"	20,000	"
Key West Fla	"	10,000	"

Plans and estimates furnished for the erection of new and the rebuilding of old works. Address

Kerr Murray Mfg. Co.,

FORT WAYNE, IND.

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,

GREENPOINT, BROOKLYN, N. Y.

ENGINEER AND MANUFACTURER OF

GAS-HOLDERS.

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plant for Lighting Cities, Towns, Mansions, and Manufactories.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works. Rolling Mill Machinery and Heavy Castings a Specialty.

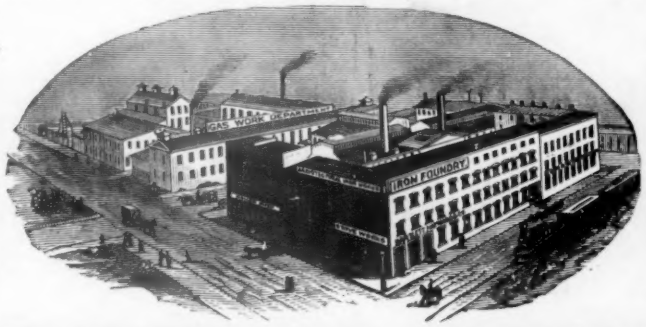
Foundry: 33, 35, 37 & 39 Mill Street. **Wrought Iron Works:** 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

BARTLETT, HAYWARD & CO.,

Office, German & Calvert. **BALTIMORE, MD.** Works, Pratt & Scott.

PURIFIERS. Roofs. Bench Castings.



SCRUBBERS. BOILERS. CONDENSERS

GASHOLDERS.

CONSTRUCTING ENGINEERS AND BUILDERS OF GAS WORKS.

1842. DEILY & FOWLER, 1886.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

MANUFACTURERS OF

GASHOLDERS,

Single or Telescopic, with Cast or Wrought Iron Guide Frames.

Holders Built Since 1881:

Scranton, Pa. (2d)	Hollidaysburg, Pa.	Jackson, Mich.	Montgomery, Ala.	New Castle, Pa.
West Point, N. Y.	Galveston, Texas (2d.)	Kalamazoo, Mich. (3d.)	Newport, R. I.	Long Island City, N. Y.
Fitchburgh, Mass.	Marlboro, Mass.	Glen Island, N. Y.	Portland, Oregon.	Macon, Ga.
New London, Conn.	Denver, Col.	Warren, Ohio.	Allegheny, Pa. (2d.)	York, Pa.
Derby, Conn.	Chicago, Ill. (West Side).	Bath, N. Y.	Atlanta, Ga. (2d.)	Chester, Pa.
Bridgeport, Conn.	Pittsburgh, Pa. (S. Side).	Lynn, Mass.	N.Y.City (Central Gas Co)	Hazleton, Pa. 2d.)
Allegheny, Pa. (1st.)	Pawtucket, R. I.	New Bedford, Mass.	Lynchburg, Va. (2d.)	Novelties Exhib., Phila
St. Hyacinth, Can.	Brookline, Mass.	Waterbury, Conn.	Saylesville, R. I.	Staten Island, N. Y.
Norwalk, O.	Sherbrooke, Can.	Deseronto, Can.	Rondout, N. Y.	Saugerties, N. Y.
Brattleboro, V	Burlington, N. J. (2d.)	Hoosic Falls, N. Y. (2d.)	Atlantic City, N. J.	Clinton, Mass. (Lan. M
Waltham, Mass. (2d.)	Bridgeton, N. J.	Bethlehem, Pa.	Augusta, Ga.	Chattanooga, Tenn.
West Chester, Pa.	Bay City, Mich.	Atlanta, Ga. (1st.)	Waltham, Mass. (2)	Galveston, Texas. (3d.
Baltimore, Md.	Erie, Pa.	Savannah, Ga.	Mahanoy City, Pa.	Omaha, Neb.

GAS COALS. GAS ENRICHERS. EXHAUSTERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

General Sales Agents for

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

The Coal from the Ocean Mine (recently operated by Messrs. W. L. Scott & Co., of Erie, Pa.,) is now used by all the leading Gas Companies in the United States from Maine to Texas, and is recognized as *the only reliable Youghiogheny Gas Coal.* (See Map on p. 87 of this Journal, Feb. 16, 1885.)

P. O Box 3695, New York **PERKINS & CO., 228 and 229 N. Y. Produce Exchange.** BEAVER STREET ENTRANCE.

BRECKENRIDGE CANNEL,

OF KENTUCKY.

This colliery was re-opened in June of the present year, and the Cannel is now being delivered to thirty of the leading Gas Companies in this country. As an enricher ONE TON of this Cannel will do the work of TWO TONS of any other available Cannel. It can be delivered in parcels of one car load or more to any point in the United States or Canada. (See AMERICAN GAS LIGHT JOURNAL, June 16, '86, pp. 346–7.)

P. O. Box 3695, New York. **PERKINS & CO., 228 and 229 N. Y. Produce Exchange** BEAVER STREET ENTRANCE.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U. S., Room 93, Nos. 2 & 4 Stone St., N.Y. City.

O. J. BENHAM, President. C. M. HIGGINS, Secretary. L. H. SEVERANCE, Treasurer.

The Forest City Naptha Co.,

REFINERS OF

Red Crown Brand

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHINC COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order **CAP BURNERS** to burn any amoun under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th Street, Phila., Pa.

The Wilbraham Gas Exhauster,

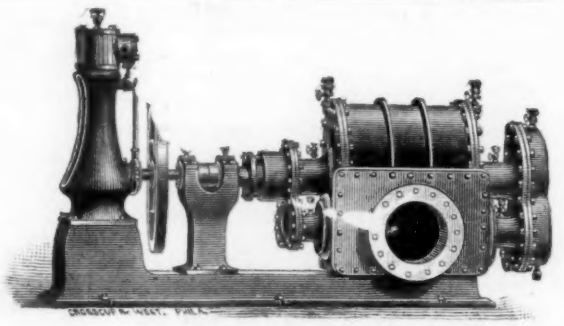
"BAKER SYSTEM,"

WITH ENGINE ATTACHED, ON SAME BED PLATE OR WITHOUT.

Best, Cheapest and Most Durable Exhauster known.

WILBRAHAM BROS.,

No. 2320 Frankford Avenue, Philadelphia, Pa.



COKE CRUSHERS.

Newburgh Orrel Coal Co.,

MINERS AND SHIPPERS OF

Mountain Brook Steam and Smithing Coals,

AURORA, TYRCONNELL & PALATINE GAS COALS.

Foundry & Crushed Coke Shipped Direct from Ovens

Mines Situated at

Newburgh, Flemington & Fairmont, W.Va.

HOME OFFICE,

33 S. Gay St., Baltimore.

CHAS. MACKALL, Gen. Mangr.

CHAS. W. HAYS, Agent in New York,

Room 147, WASHINGTON BUILDING, **No. 1 Broadway.**

Shipping wharves at Locust Point, Baltimore.

THE DESPARD COAL COMPANY

OFFER THEIR SUPERIOR

DESPARD COAL

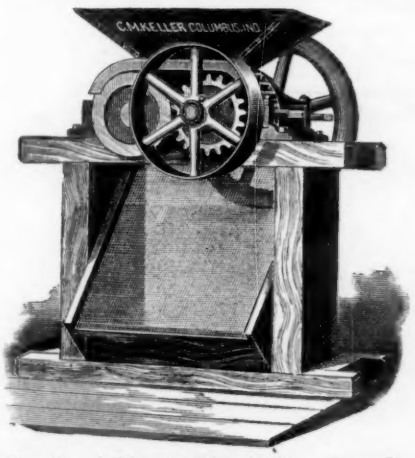
To Gas Light Companies and Manufacturers of Fire Clay Goods Throughout the Country.

ROUSSEL & HICKS, 71 Broadway, N. Y. *AGENTS.* BANGS & HORTON, 16 Kilby St., Boston.

Mines in Harrison Co., West Va. Wharves, Locust Point, Balt.

Company's Office, 15 German St., Baltimore, Md.

Among the consumers of Despard Coal we name: Manhattan Gas Light Co., N. Y.; Metropolitan Gas Light Co., N. Y.; Jersey City, (N. J.) Gas Light Co.; Washington (D. C.) Gas Light Co.; Portland (Maine) Gas Light Co. Reference to them is requested.



Keller's Adjustable Coke Crusher.

SIMPLE, STRONG, AND DURABLE.

C. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. **Columbus, Ind.**

Correspondence Solicited.

PATENTED

GAS COMPANIES, ATTENTION!

Increase the demand for Coke by using the

Star Coke Breaker.

SIMPLE, CHEAP, DURABLE. EASILY SHARPENED BY ANY BLACKSMITH.

B. J. ALLEN, Newark Gas Co., Newark, N.J.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published.

Three Vols. Bound, $30.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

GAS COALS. GAS COALS.

THE

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS,

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, Sales Agent. | **OFFICE, 150 BROADWAY, N. Y.**

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

A. M. SCOTT, PRESIDENT. A. DEMPSTER, C.E., SECRETARY. W. K. GILLESPIE, TREASURER.

MONONGAHELA AND PETERS CREEK GAS COAL CO.,

PRODUCERS OF

Coal Bluff Gas Coal.

MINES LOCATED ON THE MONONGAHELA DIVISION OF THE PENNSYLVANIA RR., IN THE CENTRAL PORTION OF THE PITTSBURGH COAL FIELD.

Points of Shipment—Buffalo, Cleveland, Erie, Chicago, New Orleans.

Since the introduction of Coal Bluff Gas Coal it has taken rank among the few first-class Gas Coals, and acknowledges no superior in gas-giving qualities, ease of working, quality of coke, and freedom from impurities.

General Eastern Agents, ANDREW LANGDON & CO., Buffalo, N. Y.
General Western Agents, ANDREW LANGDON & CO., Chicago, Ill.
Milwaukee Agents, F. R. BUELL & CO., - - - Milwaukee, Wis.

General Office, 43 Sixth Ave., Pittsburgh, Pa.

GAS METERS. GAS METERS. GAS METERS.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

Twelfth and Brown Streets, Philadelphia, Pa. No. 49 Dey Street, N. Y. City, and No. 75 North Clinton Street, Chicago, Ill.

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

Dry Gas Meter.

With 39 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

SCIENTIFIC BOOKS.

We are prepared to furnish to Gas Managers, and others interested in the topics treated of, the following books, at prices named:

KING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

TECHNICAL GAS ANALYSIS. $2.80.

GAS MANAGER'S HANDBOOK, by THOS. NEWBIGGING. $4.80.

GAS CONSUMER'S GUIDE. $1.

A GUIDE TO GAS LIGHTING. 40 cents.

GAS MEASUREMENT AND GAS METER TESTING, by F. W. HARTLEY. $1.60

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $8.

COAL; ITS HISTORY AND USE, by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

THE GAS FITTER'S GUIDE, Showing the Principles and Practice of Lighting with Coal Gas, by JOHN ELDREDGE. 40 cents.

GAS WORKS, AND MANUFACTURING COAL GAS, HUGHES. $2.20.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHREYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

HOW TO MANAGE GAS, by F. WILKINS. Paper. 20 cents.

THE GAS MANAGER IN THE LABORATORY, by a Practical Student. 8vo., Cloth. $1.50.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR by GEO. LUNGE. $8.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

GAS AS A SOURCE OF LIGHT, HEAT, AND POWER, by C. J. R. HUMPHREYS. 10 cents.

GAS COMPANIES DIRECTORY. $10.

GAS VERSUS ELECTRIC LIGHT. 50 cents.

PURIFICATION OF COAL GAS, by R. P. SPICE. 8vo. $3.

The above will be forwarded by express, upon receipt of price. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., No. 42 Pine Street. New York.

KING'S TREATISE ON COAL GAS.

The most complete work on Coal Gas ever published. Three vols., bound $30

A. M. CALLENDER & CO., No. 42 Pine Street, New York.

GAS METERS. GAS METERS. GAS METERS.

T. C. HOPPER, Pres. G. J. McGOURKEY, Vice-Pres. (New York). WM. N. MILSTED, Gen. Supt. & Treas. (New York). WM. H. DOWN Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES,
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco

HELME & McILHENNY,

(Successors to Harris & Brother. Established 1848.)

GAS METER MANUFACTURERS,

CONTINUE AS HERETOFORE AT THE OLD ESTABLISHMENT,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

To Manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers

COVERNORS, INDICATORS, PHOTOMETERS, & ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

From our long practical experience of the business, and from our personal supervision of all work, we can guarantee all orders to be executed promptly and in every respect satisfactorily.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. S. L. JONES, Sec. S. V. MERRICK, Supt.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. *142 Chambers St., New York.*
76 Dearborn St., Chicago, Ill.

WALDO BROS., Agents, 88 Water St., Boston.

MANUFACTURERS OF THE "SUN DIAL" GAS STOVES, FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

GOODWIN'S IMPROVED LOWE'S JET PHOTOMETER.

Agents for Brav's Patent Gas Burners and Lanterns.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

G. B. EDWARDS, Mang'r, New York.
E. H. B. TWINING, Mang'r, Chicago.
Represented by A. B. STANNARD.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (29 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's BADGE, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

GAS STOVES. GAS STOVES. GAS STOVES.

THE GOODWIN GAS STOVE AND METER CO.,

1012-18 Filbert St., Phila., 142 Chambers St., N. Y., 76 Dearborn St., Chicago.

Agents, WALDO BROTHERS, 88 Water Street, Boston.

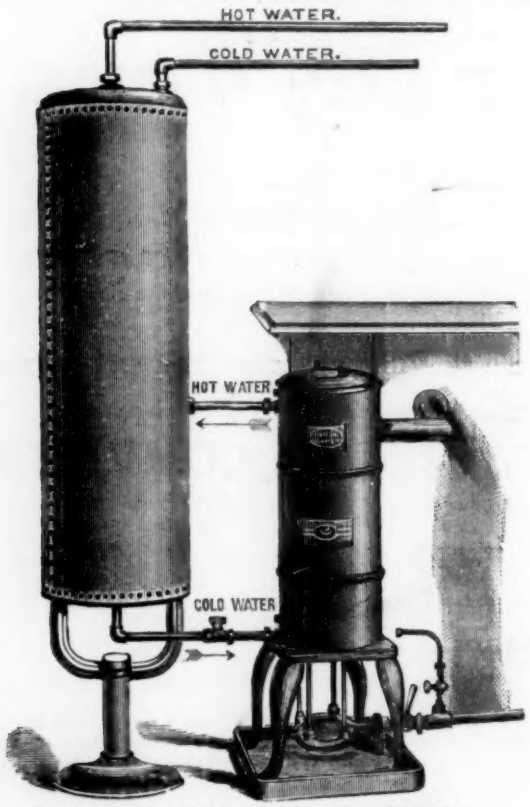
WM. W. GOODWIN, PRES. & TREAS.
W. H. MERRICK, VICE-PRES.
LEWIS JONES, SEC.
SAMUEL V. MERRICK, SUPT.

SOLE MANUFACTURERS OF THE

G. B. EDWARDS, Mang'r, N. Y.
E. H. B. TWINING, Mang'r, Chicago.
Represented by A. B. STANNARD.

"SUN DIAL" GAS STOVES

The Most Economical, Efficient, and Durable Gas Stove Made.



I.—Safety Hot Water Generator and Boiler.

II.—Gas Cooking Stove No. 8 B.

Safety Hot Water Generator and Boiler.

Cut I. represents our Safety Gas Hot Water Generator and Boiler, arranged for home use. This most easy, quick, and economical way of preparing a warm bath, or for heating water for any omestic purpose, entirely supersedes any necessity for the use of ranges or stoves—a great comfort, particularly in hot weather. The boiler being self-filling, as the hot water is drawn off, can never become empty, thus preventing the possibility of any accident.

We beg to call attention to the cast iron pan which is now attached to the legs of the Generator (see illustration). This is to catch the drippings from the Coil, which many persons suppose come from a leak, when in fact they are produced by condensation. This condensation is cause by he hot flame coming in contact with the coil filed with cold water.

New Style Gas Cooking Stove.

Cut II. represents our New Style Cooking Stove. As will be seen, it has an ornamented cast iron base and front, and extension shelves. The oven burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent applied for). The ovens are of greater capacity than those of the old style. The top, in conjunction with the outlet pipe, is designed to carry off all products of combustion; hence the outlet pipe must be connected with a flue, or the stove will not work properly.

This Stove has 4 boiling burners in top of hot plate. All fittings are nickel plated. We are making this style of Cooking Stove in the following sizes—viz., No. 7 B, No. 8 B, No. 9 B, and No. 10 B.

III.—Improved Hot Plate, No. 108.

New Style Hot Plates.

Cut III. represents our New Style of Hot Plates, of which we are making No. 106 (two small boiling burners), No. 107 (two medium sized boiling burners), and No. 108 (two medium and one large boiling burner). See new Catalogue and Price List for further particulars.